Association between Temporomandibular Disorders and Occupations by Korean Standard Classification of Occupations

Ji-Su Kim[1], Young-Ae Kim[1], Jun-Young Heo[1], Soo-Min Ok[1],
Kyung-Hee Kim[2], Yong-Woo Ahn[1], Sung-Hee Jeong[1]

[1]Department of Oral Medicine, School of Dentistry, Pusan National University, Yangsan, Korea
[2]Department of Oral Medicine, Inje University Busan Paik Hospital, Busan, Korea

Correspondence to:
Sung-Hee Jeong
Department of Oral Medicine, Dental Research Institute, School of Dentistry, Pusan National University, 49, Busandaehak-ro, Mulgeum-eup, Yangsan 626-870, Korea
Tel: +82-55-360-5230
Fax: +82-55-360-5234
E-mail: drcookie@pusan.ac.kr

Purpose: The purpose of this study was to investigate occupational distribution of temporomandibular disorders (TMD) patients and their diagnosis according to occupations and to evaluate the relationship between TMD and occupations. Work-related factors which might aggravate TMD symptoms were also evaluated.

Methods: We investigated 316 TMD patients, aged from 13 to 65 years old, who had visited the Department of Oral Medicine in Pusan National University Dental Hospital. The subjects who have a job were assessed using TMD analysis examination and occupation questionnaire. The level of significance was p-value<0.05.

Result: This study presented that the diagnoses according to occupations were not significant, but work-related factors such as verbal work and poor posture were related with TMD symptoms.

Conclusions: Proper education is essential to prevent aggravation of TMD symptoms because TMD symptoms were more related to work environment than a specific occupation.

Key Words: Occupations; Questionnaires; Temporomandibular joint disorders

INTRODUCTION

Temporomandibular disorders (TMD) is a musculoskeletal disease with pain in the masticatory muscle and the temporomandibular joint (TMJ), clicking, immobility, etc.[1,2] TMD is highly prevalent in the general Korean population.[3] It has been reported that 1%-75% of Koreans have shown more than one objective TMD sign, and 5%-33% have reported subjective symptoms.[4,5] TMD is caused by various complex causes. Its major causes are occlusal condition, trauma, emotional stress, deep pain input, parafunctional activity, etc.[6]

Previous investigators have examined the prevalence of musculoskeletal diseases among office workers.[7] In addition, in 2008 in Japan, it was reported that TMD was more prevalent among office workers than in the general population, which revealed the association of office workers with TMD symptoms.[8] In laborers exposed to an environment of repeated movements for a long time, inappropriate posture, excessive force, insufficient rest, etc., microtrauma may accumulate resulting in musculoskeletal disorders.[9] Therefore, the association of TMD,[1-2] the representative disease in orofacial area, with the patient's occupation must be evaluated. In several studies, the association of specific occupations (musicians, office workers, etc.) with TMD symptoms has been shown, and the possibility that a special working environment, such as using computer for a long time, will aggravate TMD symptoms has been discussed.[10-12] However, studies on the association of general occupations with TMD are still insufficient. Thus, in this study, the association of

occupations with TMD was assessed by examining the occupations of the patients with TMD symptoms, the working conditions and environment that may aggravate TMD symptoms as well.

MATERIALS AND METHODS

1. Subjects

This study was conducted from June 2014 to November 2014 at the Department of Oral Medicine in Pusan National University Dental Hospital. The subjects were patients whose chief complaint was TMD, aged from 13 to 65 years old. Office workers, students, and homemakers were included among the research subjects, and unemployed and retired patients, and patients on leave were excluded. Temporomandibular examination and a questionnaire survey related to the occupation were administered on a total of 432 patients (Appendix 1). Among the patients participated in the questionnaire survey, the 116 patients who did not satisfy the standard were excluded from the research subjects. Then statistical analysis was performed (Table 1). This study was conducted after obtaining the approval of the Ethics Committee of Pusan National University Dental Hospital (IRB No. PNUDH-2014-024).

2. Methods

The questionnaire for TMD patients and the diagnoses were examined via chart-review. The pain level at the initial diagnosis was evaluated through the sum of 'yes' responses in part 1 of the questionnaire for TMD patients (0-9 points; Appendix 2). Based on the research diagnostic of temporomandibular disorders (RDC/TMD), the diagnoses of the patients were classified into masticatory muscle disorders (MMD), articular disc displacement (DD), articular disorder (osteoarthritis, arthralgia, and osteoarthrosis), and others. The patients with more than two diagnoses were

classified as combined. The occupation-related questionnaire (Appendix 1) consisted of 33 questions was divided into those on personal information, the patient's occupation, and the characteristics of the occupation. The survey was conducted by asking the respondent to mark or directly write the answer on the questionnaire. The occupations were classified into 12 types, including student and housewife based on the Korean standard occupation classification (Appendix 3).[13]

3. Statistics

The research subjects were divided into male and female, and their characteristics were analyzed using a chi-square test. The level of TMD symptoms of the groups were compared through an independent t-test. Using Pearson's correlation, the correlation of the characteristics of the occupation with TMD symptoms was evaluated. All the statistical analyses were performed with IBM SPSS Statistics version 20.0 for Windows (IBM Co., Armonk, NY, USA). The level of significance was determined at the p-value<0.05.

RESULTS

1. Characteristics of the Subjects

The general characteristics of the study subjects were examined. Regarding their age distribution, most of the male subjects were in their 20s (49.4%), and most of the female subjects were in their 30s (26.8%). Most subjects were single, accounting for 65.5% (male) and 53.9% (female), respectively. As for the education level, most of the male (43.5%) and female (45.5%) subjects were college graduates (Table 2).

Working hours and conditions of the research subjects, poor posture, loads delivered to TMJ, driving, computer use, and verbal communication work were examined. Most of the male and female subjects responded that the number of their working hours was 9-12 hours, 50.6% and 46.2%, respectively. Most of male and female subjects responded that their working hours were daytime, 91.1% and 79.7%, respectively. Regarding poor postures, 75.0% of male subjects and 57.3% of female subjects answered 'no'. On the other hand, regarding whether they used computer or their work was heavily engaged in verbal communication work, most

Table 1. Distribution of gender and age in the subjects

Gender	Number of patients	Age (y)
Male	85 (26.9)	29.81±12.94
Female	231 (73.1)	32.40±12.77
Total	316 (100.0)	31.71±12.84

Values are presented as number (%) or mean±standard deviation.

Table 2. The character of study population

			Male	Female	Total	p-value
General	Age (y)	13-19	13 (15.3)	30 (13.0)	43 (13.6)	0.093
		20-29	42 (49.4)	81 (15.1)	123 (38.9)	
		30-39	14 (16.5)	62 (26.8)	76 (24.1)	
		40-49	6 (7.1)	23 (10.6)	29 (9.2)	
		50-59	6 (7.1)	29 (12.6)	35 (11.1)	
		60-65	4 (4.7)	6 (2.6)	10 (3.2)	
	Marital status	Unmarried	55 (65.5)	124 (53.9)	179 (57.0)	0.067
		Married	29 (34.5)	106 (46.1)	135 (43.0)	
	Education	Elementry	4 (4.7)	15 (6.5)	19 (6.0)	0.899
		Middle	7 (8.2)	19 (8.2)	26 (8.2)	
		High	37 (43.5)	92 (39.8)	129 (40.8)	
		University	37 (43.5)	105 (45.5)	142 (44.9)	
Work-related factors	Work time (hr)	<9	32 (40.5)	79 (45.7)	111 (44.0)	0.746
		9-12	40 (50.6)	80 (46.2)	120 (47.6)	
		>12	7 (8.9)	14 (8.1)	21 (8.3)	
	Work type	Day time	72 (91.1)	137 (79.7)	209 (83.3)	0.151
		Night time	3 (3.8)	13 (7.6)	16 (6.4)	
		Three-shift	1 (1.3)	8 (4.7)	9 (3.6)	
		Etc.	3 (3.8)	14 (8.1)	17 (6.8)	
	Poor posture	Yes	20 (25.0)	82 (42.7)	102 (37.5)	0.006*
		No	60 (75.0)	110 (57.3)	170 (62.5)	
	Loading on TMJ	Yes	42 (49.4)	63 (27.3)	105 (33.2)	0.001*
		No	43 (50.6)	168 (72.7)	211 (66.8)	
	Driving	Yes	8 (10.4)	6 (3.4)	14 (5.7)	0.031
		No	69 (89.6)	164 (96.5)	233 (94.3)	
	PC use	Yes	52 (65.8)	123 (69.1)	175 (68.1)	0.603
		No	27 (34.2)	55 (30.9)	82 (31.9)	
	Verbal work	Yes	47 (61.0)	124 (72.9)	171 (69.2)	0.060
		No	30 (39.0)	46 (27.1)	76 (30.8)	

TMJ, temporomandibular joint; PC, personal computer.
Values are presented as number (%).
The total number of patients for each item is different because of the different number of patients responded to each item.
p-value was determined by chi-square test.
*p<0.05.

male and female subjects answered 'yes' (Table 2).

The subjects were divided into male and female groups, and classified according to the diagnosis standard. The diagnosis among the male subjects was combined (38.8%), DD (24.7%), articular disorder (16.5%), and MMD (15.3%). Among the females, the order was combined (51.1%), MMD (17.7%), DD (16.5%), and articular disorders (12.6%) (Fig. 1).

2. Distribution of the Occupations and Diagnoses of the Subjects

The subjects were divided into male and female groups, and the distribution of their occupation was assessed. Most male and female subjects were students, 38.8% and 27.0%, respectively. Among the male subjects, most were students, followed by clerks (15.3%), professionals (10.6%), armed
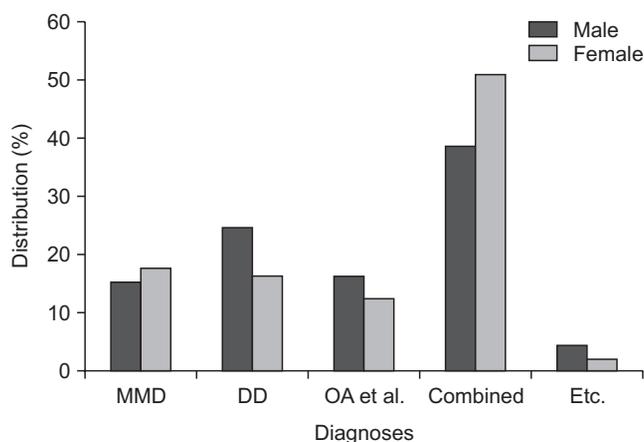

Fig. 1. Distribution of the diagnoses in the study population. Tested with the chi-square test. MMD, masticatory muscle disorders; DD, articular disc displacement; OA et al., osteoarthritis, arthralgia, osteoarthrosis; Combined, two or more diagnoses; Etc., other diagnoses.

forces (9.4%), manager, and craft and related trade work-ers (5.9%). On the other hand, among the female subjects, most were students, followed by homemakers (26.0%), pro-fessionals (19.0%), clerks (13%), service workers (6.5%), and sales workers (4.3%). The gender-specific occupations were in terms of skilled agriculture, forestry and fishery workers, plant and machine operators and assemblers, armed forces, and homemakers (Fig. 2).

The diagnoses were assessed according to the occupation of the subjects. Although the distributions of the diagnoses in various occupational groups differed, the difference was
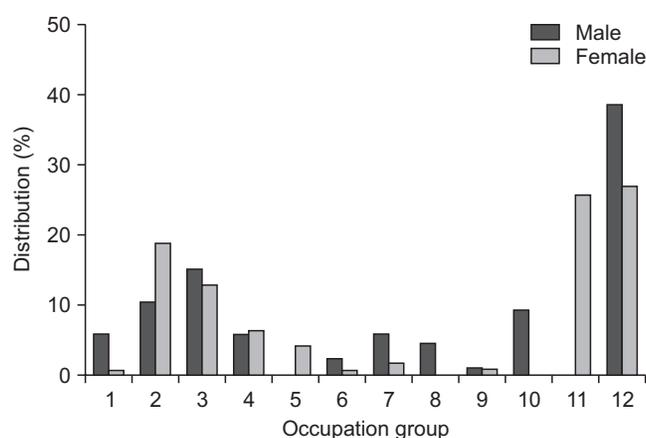

Fig. 2. Distribution of occupations in the study population. Tested by chi-square test. 1, legislators, senior officials and managers; 2, professionals; 3, clerks; 4, service workers; 5, sales workers; 6, skilled agriculture, forestry and fishery workers; 7, craft and related trades workers; 8, plant and machine operators and assemblers; 9, elementary occupations; 10, armed forces; 11, homemakers; 12, students.

not significant. Concerning the diagnoses, except in techni-cians and related skilled workers, the ratio of the combined was highest (Table 3).

3. Association of the Characteristics of the Occupations with TMD Symptoms

The association of the characteristics of the occupations of the subjects with their TMD symptoms was evaluated. Of the characteristics of occupations, the average TMD symp-toms of the group who responded 'yes' to verbal communi-cation work (p=0.022) or poor posture (p=0.010) was much higher than the group responded 'no' (Table 4). On the other hand, although the average TMD value of the group using computers and the group whose work involved the mandib-ular joint load was higher than the other groups, the differ-ence was not significant (Table 4).

Particularly, in occupations that engaged in verbal com-munication work, as the duration of the verbal commu-nication became longer, the level of TMD symptoms was

Table 4. Difference of TMD symptom between 'yes' and 'no' group according to work-related factors

Work-relate factor	Yes	No	p-value
Verbal work	5.35	4.67	0.022*
Poor posture	5.63	4.94	0.010*
PC use	5.21	4.87	0.233
Loading on TMJ	5.49	5.01	0.066

TMD: temporomandibular disorders; PC, personal computer; TMJ, temporomandibular joint.
p-value was determined by independent t-test.
*p<0.05.

Table 3. The distribution of diagnosis by occupation

Group	MMD	DD	Arthralgia	Combined	Etc.	Total
1	1 (16.7)	0 (0)	2 (33.3)	3 (50.0)	0 (0)	6 (1.9)
2	10 (18.9)	8 (15.1)	6 (11.3)	28 (52.8)	1 (1.9)	53 (16.8)
3	7 (16.3)	11 (25.6)	2 (4.7)	22 (51.2)	1 (2.3)	43 (13.6)
4	4 (20.0)	1 (5.0)	4 (20.0)	8 (40.0)	3 (15.0)	20 (6.3)
5	1 (10.0)	2 (20.0)	3 (30.0)	4 (40.0)	0 (0)	10 (3.2)
6	0 (0)	1 (33.3)	1 (33.3)	1 (33.3)	0 (0)	3 (0.9)
7	4 (44.4)	0 (0)	2 (22.2)	3 (33.3)	0 (0)	9 (2.8)
8	0 (0)	0 (0)	2 (50.0)	2 (50.0)	0 (0)	4 (1.3)
9	1 (33.3)	0 (0)	0 (0)	2 (66.7)	0 (0)	3 (0.9)
10	0 (0)	1 (12.5)	2 (25.0)	5 (62.5)	0 (0)	8 (2.5)
11	8 (13.3)	9 (15.0)	10 (16.7)	33 (55.0)	0 (0)	60 (19.0)
12	18 (18.6)	26 (26.8)	9 (9.3)	40 (41.2)	4 (4.1)	97 (30.7)

MMD, masticatory muscle disorders; DD, articular disc displacement.
Values are presented as number (%).

Ji-Su Kim, et al. Association between TMD and Occupations by KSCO

21

Table 5. Correlation between verbal work time and TMD symptom

	Verbal work time	TMD symptom
Verbal work time	1	0.298 (0.034*)
TMD symptom	0.298 (0.034*)	1

TMD: temporomandibular disorders.
p-value was determined by Pearson's correlations.
*p<0.05.

Table 6. Correlation between number of poor postures and TMD symptom

	Number of poor postures	TMD symptom
Number of poor postures	1	0.195 (0.001*)
TMD symptom	0.195 (0.001*)	1

TMD: temporomandibular disorders.
p-value was determined by Pearson's correlations.
*p<0.05.

elevated (p=0.034; Table 5). In the group with poor postures, as the number of poor postures increased, the level of TMD symptoms was elevated (p=0.001; Table 6). The poor postures that caused TMD symptoms included in the questionnaire were the posture while watching a monitor, the posture with neck bent downward while sitting, the standing posture, the posture with waist bent downward, etc. The subjects were asked to select all relevant postures.

4. Evaluation of the Factors Other than the Characteristics of Occupations That Affected TMD Symptoms

Besides the characteristics of occupations, the association with other factors such as sleep hours, oral habits, and job satisfaction level with TMD were assessed. The sleep hours were found to be negatively correlated with the TMD symptoms, but the correlation was not significant. However, when the correlation in each occupation group was assessed separately sleep hour was found to be significantly positively correlated to TMD symptoms in the professional group (p=0.031). In addition, although the average TMD value of the group with oral habits was higher (5.24) than the other group (4.64), the difference was not significant. On the other hand, regarding the level of job satisfaction, high job satisfaction level was shown to be correlated to the increased TMD symptoms (p=0.001).

DISCUSSION

Modern workers are exposed to excessive workloads. During such work, if bad habits, poor posture, etc. are maintained for a long time, they may adversely affect the musculoskeletal system. Generally, among the causes of work-related musculoskeletal disorders, physical factors are important, and the most affected sites are the neck, shoulder, and waist.[9] Numerous studies have reported musculoskeletal disorders in manufacturing jobs engaging physical activities. Recent trends show the rising interests on office workers using video display terminals (VDTs).[14] In this study, TMD, the musculoskeletal disease in the orofacial area, was most prevalent in students, followed by homemakers, professionals, clerks, and service workers. Similarly, in this study, the occupations related to office works had the largest proportion, and blue-collar jobs showed the lowest ratio less than 3%.

Several studies have reported that VDT work, particularly computer work, might adversely affect TMD symptoms.[8,10,11] When working with computers, workers watch monitors for a long time while sitting on a chair. During such time, if the environment such as the location of a monitor, keyboard, etc. is improper, bad postures can be readily induced, and thus, TMD symptoms may develop. In this study, 68.1% of the subjects, more than half of the subjects, responded that they used computers at work. When TMD symptoms according to the duration of computer use were assessed, they were found be not significant, perhaps due to the smaller number of the subjects than previous studies. Thus, such association must be re-evaluated in a larger number of subjects.

This study was conducted for six months. The occupation, diagnosis, and characteristics of occupation of the patients who visited the Busan National University Dental Hospital with the chief complaint of TMD were evaluated through temporomandibular examination and questionnaire surveys. The average age of the subjects was 31.71 years. In the entire study population, the ratio of females was 73.1%, which was more than two times higher than males. This concurs to the previous studies reported that the prevalence in female subjects was two to five times higher than male subjects.[15,16] Such discrepancy in the prevalence rates may

be due to the differences in the subjects' pain sensitivity, cultural backgrounds,[17] hormones,[18] etc. Nonetheless, the causes have not yet been clearly characterized. As for the age distribution, most of the male subjects were in their 20s, and most of the female subjects were in their 30s. These results concur to most epidemiological studies showed that TMD symptoms occurred mostly in the 20 to 40 years old population.[4,19,20]

In the assessment of job characteristics of the study subjects, in both male and female subjects, 9 to 12 working hours were most common. As for the working conditions, daytime jobs were most common. Concerning the questions of the correlation of poor posture to TMJ loads, and those related to driving, most of the patients responded 'no.' On the other hand, to the questions on the correlation with computer use and verbal communication, most of the patients responded 'yes' (Table 4). Thus, it could be inferred that white-collar jobs were more abundant. Nevertheless, the patients might not have been aware of the questions related to poor posture, which might have been why the prevalence of poor posture was lower than the actual values.

On the distribution of the diagnoses according to the occupation, except for craft and related trades workers, the ratio of the combined diagnosis was highest. DD was diagnosed most often in the students; articular disorders in the homemakers; MMD in the professionals; articular disc disorders in the clerks; and MMD and articular disorders in the service workers. Since different occupations have different characteristics, it was anticipated that the distributions of the diagnoses in different occupation groups would significantly differ. However, although the distribution of the diagnoses according to the occupation differed, the difference was not statistically significant. This might have been due to the small number of samples. Thus, the results must be re-evaluated by conducting the same study on a larger number of subjects.

This study revealed that among the various characteristics of the subjects' occupations, verbal communication work might affect TMD symptoms. Verbal communication includes telephone consultations, lectures, meetings, etc. When one talks much, usage of the musculoskeletal system around TMJ increases. If verbal communication work surpasses adaptability of the patient, TMD symptoms may occur. In the occupational groups responded that their level of verbal communication work was high, the number of professionals was highest, followed by students and clerks, in order. Since TMD symptoms may occur or be aggravated in the occupations with heavy engagement in verbal communication and are associated with the number of working hours, awareness of such risk factors and their prevention through appropriate education is required.

This study revealed that occupations that might cause poor posture were associated with TMD symptoms. However, the association of the postures with TMD is still controversial. In some studies, the positions of the head, neck, and shoulders are attributed to TMD symptoms.[21,22] On the other hand, several studies did not support this.[23-25] Among the subjects who responded that they had such poor postures, the highest proportion was that of students, followed by professionals, and homemakers. Poor posture induces imbalance of body parts, which increases tension of the supporting structure and induces pain or injury. Particularly, among various postures, anterior head position is important because it may be involved in inducing pain in head and neck area, shoulders, and some other areas that induce TMD.[26] Based on the questionnaire, the poor postures that induce TMD symptoms include the posture while watching monitors, posture of bending head forward while sitting, standing posture, posture bending waist downward, etc. The subjects were asked to select all corresponding postures. Particularly, the first three postures induce forward head position that may be associated with TMD, and thus, they must be given attention. In forward head position, the patient rotates his/her head upward to see better, and such position that involves rotating the anterior head causes the extension of upper and lower geniohyoid muscles as well as the closure of the retro space between the atlas and the axis.[6] When such position is maintained, the extended geniohyoid muscles pull the mandible. In response to this, as a reflex, the elevator muscles contract. At that time, the pressure in the joint cavity of TMJ may also increase, and thus, TMD symptoms may be induced.[26] In addition, if the dynamic pressure is elevated due to such forward head position, the pain thresholds of the masseter muscle and the temporal muscle increase, and thus, sensitivity may increase.[27] Therefore, patients exposed to such

working conditions may require aggressive posture education. Wright et al. reported that in muscular TMD patients with the anterior head position, after posture training that maintained the appropriate position of the head and shoulders, TMD symptoms were reduced.[28]

In addition to the characteristics of the occupation, the association of sleep and oral habits with TMD symptoms was assessed. The results showed that in professional group, sleep was significantly inversely correlated with TMD symptoms. Although the correlation was insignificant in all the occupations, regretfully, it could be speculated that even in the group with identical occupations, depending on sleep quality or duration, the level of TMD symptoms would differ. Tae et al.[29] reported that TMD and sleep could affect each other. Kim et al.[30] reported that in adolescent TMD patients, the level of pain at the initial diagnosis was weakly inversely correlated with the number of sleeping hours. Such results were similar to those of this study. Sleep relieves physical and psychological fatigue accumulated at daytime.[31] When such sleep is interrupted, adrenal stress hormones are released gradually to the blood stream, and the psychological and physical levels could clearly drop in normal activities.[32] Thus, it is considered that sufficient sleep is required to ameliorate TMD symptoms.

Other than the characteristics of the occupation, although insignificant, the average of TMD symptoms in the groups responded that they had bad oral habits was higher than that of the other groups, but the differences among the occupation groups were not detected. Parafunctional activity may be one of the causes of TMD, or even if not, may maintain or aggravate TMD symptoms.[6] Thus, greater attention should be paid to it.

We anticipated that as job satisfaction level increased, TMD symptoms would be lower. However, the results showed that in most occupations, as job satisfaction level increased, TMD symptoms also tended to increase. It appears that job satisfaction is associated with individual achievements, and due to the voluntarily increased workloads to obtain happiness derived from achievements, TMD symptoms may be aggravated.

This study was a one-dimensional study, and thus, had limitations in assessing the cause-effect of factors associated with TMD symptoms. It had other limitations. In addition

to the previously mentioned characteristics of the occupation, sleep, and bad habits, other factors such as previous trauma and stress may cause TMD, but such factors were not investigated in this study, so their influence could not be evaluated. In the future, additional studies that examine various factors with a larger sample size are required.

Occupational distribution of TMD patients was assessed. Most of the male patients were students, followed by clerks, professionals, armed forces, managers, Craft and related Trades workers, in order. Most of the female patients were also students, followed by homemakers, professionals, clerks, service workers, and sales workers, in order. In addition, the distribution of the diagnoses according to the occupational group was assessed. Although the ratios of the diagnoses of the groups of various occupations differed, the difference was not statistically significant. Nonetheless, occupations focused on verbal communication and occupations that induced bad posture were associated with TMD symptoms. In conclusion, the working environment of individuals had a greater influence on their TMD than did their occupation. Therefore, workers with such risk factors need appropriate education to prevent their development of TMD or the aggravation of their TMD symptoms.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. Okeson JP, Bell WE. Bell's orofacial pains: the clinical management of orofacial pain. 6th ed. Chicago: Quintessence Pub. Co.; 2005. pp. 329-330.
2. Chung SC, Ko MY, Kim YJ. A study on the background variables in the patients with TMJ dysfunction. J Korean Acad Oral Med 1983;8:69-76.
3. Dworkin SF, Huggins KH, LeResche L, et al. Epidemiology of signs and symptoms in temporomandibular disorders: clinical signs in cases and controls. J Am Dent Assoc 1990;120:273-281.
4. De Kanter RJ, Truin GJ, Burgersdijk RC, et al. Prevalence in the Dutch adult population and a meta-analysis of signs and symptoms of temporomandibular disorder. J Dent Res 1993;72:1509-1518.
5. Fricton JR, Schiffmann EL. Epidemiology of temporomandibular disorders. In: Fricton JR, Dubner R, eds. Orofacial pain and

temporomandibular disorders. New York: Raven Press; 1995. pp. 1-14.

6. Okeson JP. Management of temporomandibular disorders and occlusion. 7th ed. St. Louis: Elsevier/Mosby; 2013. pp. 114-126, 306-315.

7. Bernard BP. Musculoskeletal disorders and workplace factors: a critical review of epidemiologic evidence for work-related musculoskeletal disorders of the neck, upper extremity, and low back. Atlanta: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health; 1997. Chapter 7. pp. 1-10.

8. Sugisaki M, Takano N, Kino K, et al. Prevalence of temporomandibular disorders among working population of Tokyo. J Jpn Soc TMJ 2008;20:127-133.

9. Korea Occupational Safety & Health Agency (KOSHA). The guideline of survey about risk factor relating to musculoskeletal disorders. Incheon: KOSHA; 2003. pp. 10-11.

10. Nishiyama A, Kino K, Sugisaki M, Tsukagoshi K. A survey of influence of work environment on temporomandibular disorders-related symptoms in Japan. Head Face Med 2012;8:24.

11. Perri R, Huta V, Pinchuk L, Pinchuk C, Ostry DJ, Lund JP. Initial investigation of the relation between extended computer use and temporomandibular joint disorders. J Can Dent Assoc 2008;74:643.

12. Rodríguez-Lozano FJ, Sáez-Yuguero MR, Bermejo-Fenoll A. Prevalence of temporomandibular disorder-related findings in violinists compared with control subjects. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2010;109:e15-e19.

13. The 6th amendment Korea standard occupation classification [Internet]. Daejeon: Statistics Korea; 2007 Jul 2 [cited 2014 Sep 10]. Available from: http://kostat.go.kr/portal/korea/kor_nw/2/14/1/index.board?bmode=read&taSeq=51397.

14. Chae CH, Kim YW, Yi CH, Kim JI, Kim JY, Lee SH. Symptom prevalence of work-related musculoskeletal disorders and related factors among some VDT workers in publishing industries. Korean J Occup Health 2003;42:67-75.

15. Kamisaka M, Yatani H, Kuboki T, Matsuka Y, Minakuchi H. Four-year longitudinal course of TMD symptoms in an adult population and the estimation of risk factors in relation to symptoms. J Orofac Pain 2000;14:224-232.

16. Dao TT, LeResche L. Gender differences in pain. J Orofac Pain 2000;14:169-184.

17. Krogstad BS, Jokstad A, Dahl BL, Vassend O. The reporting of pain, somatic complaints, and anxiety in a group of patients with TMD before and 2 years after treatment: sex differences. J Orofac Pain 1996;10:263-269.

18. Hatch JP, Rugh JD, Sakai S, Saunders MJ. Is use of exogenous estrogen associated with temporomandibular signs and symptoms? J Am Dent Assoc 2001;132:319-326.

19. Von Korff M, Dworkin SF, Le Resche L, Kruger A. An epidemiologic comparison of pain complaints. Pain 1988;32:173-183.

20. Dworkin SF, LeResche L, Von Korff MR. Diagnostic studies of temporomandibular disorders: challenges from an epidemiologic perspective. Anesth Prog 1990;37:147-154.

21. Lee WY, Okeson JP, Lindroth J. The relationship between forward head posture and temporomandibular disorders. J Orofac Pain 1995;9:161-167.

22. Rocabado M. Diagnosis and treatment of abnormal craniocervical and craniomandibular mechanics. In: Solberg WK, Clarck GT, eds. Abnormal jaw mechanics: diagnosis and treatment. Chicago: Quintenssence; 1984. pp. 141-159.

23. Clark GT, Green EM, Dornan MR, Flack VF. Craniocervical dysfunction levels in a patient sample from a temporomandibular joint clinic. J Am Dent Assoc 1987;115:251-256.

24. Darlow LA, Pesco J, Greenberg MS. The relationship of posture to myofascial pain dysfunction syndrome. J Am Dent Assoc 1987;114:73-75.

25. Munhoz WC, Marques AP, de Siqueira JT. Evaluation of body posture in individuals with internal temporomandibular joint derangement. Cranio 2005;23:269-277.

26. Simons DG, Travell JG, Simons LS, Cummings BD. Travell and Simons' myofacila pain and dysfunction: the trigger point manual. Vol. 1. 2nd ed. Baltimore: Williams & Wilkins; 1999. pp. 261-267.

27. Chae YW, Kim JS. The effect of involuntary muscle contraction due to forward head position in pressure pain threshold of pericranial muscle. J Korean Soc Phys Ther 2000;12:339-347.

28. Wright EF, Domenech MA, Fischer JR Jr. Usefulness of posture training for patients with temporomandibular disorders. J Am Dent Assoc 2000;131:202-210.

29. Tae IH, Kim ST, Ahn HJ, Kwon JS, Choi JH. Interaction between pain aspect and sleep quality in patients with temporomandibular disorder. Korean J Oral Med 2008;33:205-218.

30. Kim BS, Heo JY, Ok SM, et al. Cyber leisure activities and physical activities in adolescents with temporomandibular disorder. Korean J Oral Med 2013;38:187-201.

31. Lee YM. Relationship of orofacial pain and sleep quality. Korean J Oral Med 2006;31:91-99.

32. Chee IS, Shin SC. The effects of the partial differential REM deprivation on the sleep structure, sleepiness and fatigue. Chungnam Med J 1993;20:267-282.

Appendix 1. Occupation questionnaire

안녕하십니까?

본 설문지는 턱관절 장애와 직업과의 상관관계에 대한 연구를 위한 참고자료로 사용될 목적으로 작성되었으며, 학문적 연구목적 이외에는 다른 용도로 사용되지 않고 통계적인 자료처리에만 이용될 것이니 안심하시고 있는 그대로의 의견을 기입해주시면 감사하겠습니다(단, 설문에 응하는 것을 원하지 않으신다면 작성하지 않으셔도 무방합니다). 해당하는 곳에 체크(∨)하시거나 빈 칸을 채워주세요.

1. 성별
   □ 남   □ 여
2. 나이 (만   세)
3. 최종학력
   □ 초졸 이하   □ 중졸   □ 고졸   □ 대졸 이상
4-1. 결혼 여부
   □ 네   □ 아니오 → 결혼을 안하셨다면 9번으로 이동
4-2. 자녀유무
   □ 유   □ 무
5. 자녀가 있다면 자녀의 수는 몇 명입니까?
   □ 1명   □ 2명   □ 3명 이상
6. 자녀가 있다면 자녀의 나이는 몇 살입니까? (자녀 수대로 중복체크 해주세요)
   □ 1-3세   □ 4-7세   □ 8-13세   □ 14-19세   □ 20세 이상
7. 결혼을 하셨다면, 부모님과 한 집에 거주하고 있으십니까?
   □ 네   □ 아니오
8. 함께 거주하고 계신 부모님의 나이는 어떻게 됩니까? (중복체크 해주세요)
   □ 50세 미만   □ 50-60세   □ 61-70세   □ 71-80세   □ 81세 이상
9. 평소 수면 시간은 몇 시간입니까?
   □ 5시간 미만   □ 5-7시간 미만   □ 7-9시간 미만   □ 9시간 이상

10. 본인의 직업은 무엇입니까? (직업을 적으시고 아래 항목 중 하나에 표시해 주세요)
   (   )
   □ 관리자
   (예: 국회의원, 고위공무원, 기업 대표이사, 교장, 교감, 그 외 건설, 숙박, 등의 관리자 등)
   □ 전문가 및 관련 종사자
   (예: 연구원, 시험원, 프로그래머, 건축가, 기술자, 의사, 기공사, 물리치료사, 간호사, 위생사, 성직자, 교사, 성악가, 연주가, 배우, 법률, 금융 전문가 등)
   □ 사무 종사자
   □ 서비스 종사자
   (예: 경찰, 소방, 보안, 미용, 승무원, 음식 서비스직 등)
   □ 판매 종사자
   (예: 영업, 방문판매, 매장 판매, 계산원 등)
   □ 농림어업 숙련 종사자
   □ 기능원 및 관련기능 종사자
   (예: 제빵, 식품가공, 제단사, 금속성형, 자동차 정비원, 수리원, 전기원, 건축 도장공 등)
   □ 장치ㆍ기계 조작 및 조립종사자
   (예: 기관사, 운전사, 선박원, 각종기계 조작원, 각종 부품 조립원 등)
   □ 단순노무 종사자
   (예: 건설 및 광업 관련 단순 종사원, 배달원, 포장원, 환경미화원, 경비원, 육아도우미 등)
   □ 군인
   □ 주부
   □ 학생 전공이 있다면 적어주세요. (   )
   □ 무직 혹은 은퇴

*다음 항목부터는 직업이 있는 경우 체크해 주십시오. (주부, 학생 포함)
11. 직장에 근무하신 지, 혹은 전공을 시작한 지 얼마나 되셨습니까? (   )
12. 직업에 대한 만족도
   □ 불만족스럽다   □ 그저 그렇다   □ 만족스러운 편이다   □ 아주 만족스럽다
   → 음악을 전공하고 있거나 직업인 경우는 21번으로 이동, 단 교사는 제외

13-1. 하루 근무(공부)시간
　　□ 8시간 이하 　□ 8-12시간 　□ 12시간 이상
13-2. 주로 근무(공부)하시는 시간대가 어떻게 되십니까?
　　□ 주간 　□ 야간 　□ 3교대 근무
13-3. 출퇴근 시간이 일정한 편입니까?
　　□ 그렇다 　□ 아니다

14-1. 직장에서 근무(공부) 시 한 자세를 오래 유지하는 편입니까?
　　□ 그렇다 　□ 아니다
14-2. 근무(공부) 시 오래 유지하고 있는 자세는 어떤 자세입니까? (중복체크 가능합니다)
　　□ 앉아서 모니터를 보고 있는 자세
　　□ 앉아서 고개를 숙이고 있는 자세
　　□ 서있는 자세
　　□ 허리를 아래로 구부린 자세(물건을 들거나 할 때와 같이)
　　□ 기타(　　　)
15-1. 특별히 턱관절장애의 증상이 악화된다고 느껴지는 자세가 있으십니까?
　　□ 그렇다 　□ 아니다
15-2. 그렇다면 어떤 자세입니까? (중복체크 가능합니다)
　　□ 앉아서 모니터를 보고 있는 자세
　　□ 앉아서 고개를 숙이고 있는 자세
　　□ 서있는 자세
　　□ 허리를 아래로 구부린 자세(물건을 들거나 할 때와 같이)
　　□ 기타(　　　)

16. 직장에서 근무 시 무거운 물건을 옮기거나 하는 등의 근력 사용이 필요하십니까?
　　□ 그렇다 　□ 아니다
17-1. 직장에서 근무 시 아래턱 혹은 그 주변에 직접적인 힘이 주어지는 편입니까?
　　□ 그렇다 　□ 아니다
17-2. 직장에서 근무 시 두경부쪽 보호장비 착용하십니까?(예: 헬멧, 마스크)
　　□ 그렇다 　□ 아니다

18-1. 근무 시 운전을 오래 하십니까?
　　□ 그렇다 　□ 아니다
18-2. 그렇다면 하루에 운전하시는 시간은 얼마나 되십니까?
　　□ 1시간 미만 　□ 1-3시간 미만 　□ 3-5시간 미만 　□ 5시간 이상

19-1. 직장(학교)에서 근무(공부) 시 컴퓨터를 사용하십니까?
　　□ 그렇다 　□ 아니다
19-2. 컴퓨터를 사용하신다면 보통 사용시간은 얼마나 되십니까?
　　□ 1시간 미만 　□ 1-3시간 미만 　□ 3-5시간 미만 　□ 5시간 이상

20-1. 직장에서 업무상 말을 많이 해야 하는 편입니까? (예: 전화 상담, 민원 상담, 강의 등)
　　□ 그렇다 　□ 아니다
20-2. 근무 시 말을 하는 시간은 대략 어느 정도 되십니까?
　　□ 1시간 미만 　□ 1-3시간-미만 　□ 3-5시간 미만 　□ 5시간 이상

21-1. 음악을 전공하거나 직업으로 가지고 있습니까?
　　□ 그렇다 　□ 아니다
21-2. 그렇다면 전공분야는 무엇입니까? (악기가 전공이라면 무엇인지 적어주세요)
　　□ 보컬, 성악 　□ 악기(　　　)
21-3. 하루 연습시간 혹은 연주시간은 어느 정도 되십니까?
　　□ 1시간 미만 　□ 1-3시간 미만 　□ 3-5시간 미만 　□ 5시간 이상
21-4. 연습 혹은 연주 주기는 어떻게 되십니까?
　　□ 일주일에 1회 　□ 일주일에 2-3회 　□ 일주일에 4-5회 　□ 일주일에 6회 이상

Appendix 2. Questionnaire for temporomandibular disorders patients part I

예	아니오	1부
		1. 입을 벌리고 다물 때 턱에서 소리가 나며 그것이 당신이나 다른 사람을 불편하게 합니까?
		2. 턱이 잘 움직이지 않아서 자유롭게 입을 벌리지 못합니까?
		3. 입을 크게 벌리거나 씹을 때 통증이 있습니까?
		4. 귀나 귀 앞 부위에 통증이 있습니까?
		5. 얼굴, 뺨, 턱, 목구멍 또는 관자놀이에 통증이 있습니까?
		6. 원하는 만큼 입을 벌리지 못하십니까?
		7. 자주 두통으로 고생합니까?
		8. 식사를 많이 하고 난 후나 치과 치료 후 당신은 턱이 피곤하다고 느끼십니까?
		9. 아래 윗니가 불편하게 물린다고 느낍니까?

Appendix 3. The distribution of occupation

분류	명칭	세부 직업
1	관리자	공공 및 기업 고위직, 행정 및 경영지원, 전문서비스, 건설 · 전기 및 생산 관련, 판매 및 고객서비스 관리직
2	전문가 및 관련종사자	과학, 정보통신, 공학, 보건 · 사회복지 및 종교, 교육, 법률 및 행정, 경영 · 금융, 법률 및 행정, 문화 · 예술 · 스포츠전문가 및 관련직
3	사무종사자	경영 및 회계, 금융 및 보험, 법률 및 감사, 상담 · 안내 · 통계 및 기타 사무직
4	서비스종사자	경찰 · 소방 및 보안, 이미용 · 예식 및 의료보조, 운송 및 여가, 조리 및 음식 서비스직
5	판매종사자	영업직, 매장 판매직, 방문 · 노점 및 통신 판매 관련직
6	농림어업 숙련종사자	농 · 축산, 임업, 어업 숙련직
7	기능원 및 관련기능종사자	식품가공, 섬유 · 의복 및 가죽, 목재 · 가구 · 악기 및 간판, 금속성형 관련, 운송 및 기계, 전기 및 전자, 건설 및 채굴, 영상 및 통신장비, 기타 기능 관련직
8	장치기계조작 및 조립종사자	식품가공, 섬유 및 신발, 화학, 금속 및 비금속, 기계제조, 전기 및 전자, 운전 및 운송, 상 · 하수도 및 재활용 처리, 목재 · 인쇄 및 기타 기계 조작직
9	단순노무종사자	건설 및 광업, 운송, 제조, 청소 및 경비, 가사 · 음식 및 판매, 농림어업 및 기타 서비스 단순노무직
10	군인	
11	주부	
12	학생	중학생, 고등학생, 대학생, 대학원생