Musculoskeletal symptoms and psychosocial factors among patients with craniomandibular disorders

Catharina Hagberg, Mats Hagberg and Sigvard Kopp

Department of Jaw Orthopedics and Department of Clinical Oral Physiology, School of Dentistry, Karolinska Institutet, Huddinge, and National Institute of Occupational Health, Division of Work and Environmental Physiology, Solna, Sweden

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General musculoskeletal symptoms and emotional stress situations in terms of psychosocial stressors at work and sleeping disturbances were compared between patients with craniomandibular disorders (CMD) (56 women, 24 men) and a random population sample (88 men, 86 women in the Stockholm Music 1 study). A multiple-choice questionnaire was used. In comparison with the CMD men the CMD women had an increased rate of tooth clenching and muscular pain in the face. When compared with the women in the population sample, the CMD women showed increased risks for musculoskeletal pain in various parts of the body, such as neck, shoulders, thoracic back, wrist/hands, and the knees. A comparison between the CMD men and the men in the population did not show any clear differences in prevalence of general musculoskeletal symptoms. However, the CMD men differed in reporting higher scores for psychologic demands at work and also in having more sleeping disturbances. □ *Craniomandibular disorders; musculoskeletal symptoms; psychosocial factors; sleeping disturbances; stress*

Catharina Hagberg, Dept. of Jaw Orthopedics, School of Dentistry, Karolinska Institutet, Box 4064, S-141 04 Huddinge, Sweden

A medical study on Finnish metal industry plant workers showed that perceived psychosocial stress was associated with rheumatic symptoms and clinical findings of musculoskeletal disorders (1). Craniomandibular disorders (CMD) are known to have a multifactorial etiology. Dahlström et al. (2) and Mc Glynn et al. (3) have, among others, shown that experimentally induced stress increases jaw muscle activity registered with electromyography. A group of CMD patients were, in comparison with controls, shown to have increased 'relative risks' of having musculoskeletal pain especially in the upper neck, the shoulder and lower neck region, the shoulder joint, and the thoracic back (4). Discomfort and pain rating values for the neck and shoulders were significantly higher for CMD patients than for controls (4).

Karasek & Theorell (5) have presented an analysis of stress based on experience of the 'demand/control' situation at work. Standardized questions revealing how a person manages to control his demands at work are used as indices of 'psychologic demands', 'intellectual discretion', and 'authority over decisions'. The stress level is strongly correlated to these variables (5).

Sleep disturbances often arise in connection with psychosocial problems at work (6). Increased symptoms from the back, neck, and shoulders have been found in connection with sleep disturbances (7).

Despite the multifactorial background of CMD, patients with disturbances of the craniomandibular system are likely to benefit from local treatment of the masticatory system using conservative methods (8). However, effective treatment should also be directed towards background factors such as stress, which at times indirectly cause local

CMD of muscular origin mainly. When stress factors are diagnosed as being a major cause of muscular CMD, additional, general treatment of tension and stress is helpful. However, the question arises as to what extent stress among CMD patients differs from that of a general population, or whether their susceptibility or response to stress differs.

The aim of this study was to compare general musculoskeletal pain/discomfort and the emotional stress situation in terms of psychosocial stressors at work between CMD patients and a random population sample in Stockholm, Sweden. The hypothesis was that these factors exert an influence on CMD patients different from that on a population.

Subjects and methods

Of 110 CMD patients consecutively attending the Department of Clinical Oral Physiology, Huddinge, 80 patients (56 women, 24 men) were employed. Various occupations were represented, such as office employees, secretaries, technicians, craftsmen, economists, nursing staff, and sales clerks. These patients composed the study group. The patients' ordinary clinical forms for registration of CMD were available. Their ages ranged between 20 and 68 years. The mean age for the women was 42 years and for the men 37 years.

The population sample consisted of randomly chosen men and women in the county of Stockholm, Sweden (9). The selection was stratified for age and sex, so as to obtain a reference group with all ages between 20 and 64 years equally represented (9). Totally, 145 men and 141 women were asked to participate. Of these, 96 men and 90 women accepted. Employment was registered for 88 men and 86 women, who composed the population sample (9).

The population sample is a part of a longitudinal inter-center study—'The Stockholm Music investigation'—including departments at the National Institute of Occupational Health, the Karolinska Hospital, and the Karolinska Institute. The questions given to the CMD patients were chosen from the questionnaire bank of the Music investigation except for the first 8 questions (of a total of 95 questions). The first 8 questions were only answered by the CMD patients and described CMD signs and symptoms, to clarify the severity of these. The Music investigation was carried out before studying the CMD patients, and it was not possible to give the questions about CMD to the population sample. Borg's new rating scale (CR-10 rating scale) was used for assessment of discomfort or pain in the stomatognathic system (10) (Table 1). Separate assessments, choosing a numerical value from 0 to 10, were made for the right and the left side. Borg's new rating scale is a numerical category scale with verbal anchors (10). The verbal expressions are placed at selected positions on the scale in such a manner that the scale acquires the qualities of a ratio scale (10) (Table 1). None of the CMD patients refused to answer the questionnaire during their first visit. However, at times not all questions were answered. The major part of the questionnaire concerned three topics:

1) Questions about musculoskeletal discomfort/pain for different parts of the body 'right now' and 'occasionally during the past 12 months'. The musculoskeletal questions consisted of questions from a Nordic questionnaire and had a model (Fig. 1) for defining nine different parts of the body (11). Separate answers were given for

Table 1. Borg's new rating scale (a category scale with ratio properties)

0	Nothing at all
0.5	Very, very weak (just noticeable)
1	Very weak
2	Weak (light)
3	Moderate
4	Somewhat strong
5	Strong (heavy)
6	
7	Very strong
8	
9	
10	Very, very strong (almost maximal)
*	Maximal

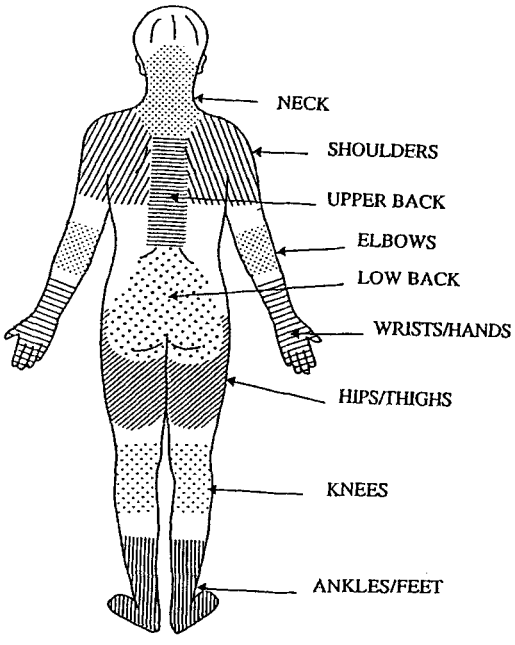

Fig. 1. A model defining nine different parts of the body.

the situation of the day—'right now'—and for 'occasionally during the past 12 months'.

2) Psychosocial questions related to the situation at work as described by Karasek & Theorell (5). Through these, indices for 'psychologic demands' (five questions: need to work fast, work hard, demands of too great effort, enough time, contradictory demands), 'intellectual discretion' (four questions: learning new things, need for skillfulness, ingenuity, repeated tasks), and 'authority over decisions' (two questions: authority to decide how to perform a task and what to perform) could be calculated. Each answer had four alternatives to choose from: 'Yes, often', 'Yes, sometimes', 'No, seldom', and 'No, practically never'. Each answer was scored 4, 3, 2, or 1. Two questions (enough time, repeated tasks) were inversely graded (1, 2, 3, 4). The psychologic demands score then received a possible width of variation from 5 to 20 units. A higher score corresponded to more psychologic demands during work. For intellectual discretion score a possible width of variation was 4 to 16 units. A high score corresponded to more stimulation. Authority over decisions had a possible variation from 2 to 8 units, with a high score corresponding to more authority in the work situation (5).

3) Questions about sleeping disturbances. Summed scores based on four questions—'difficulties in awakening', 'nightmares', 'tired/sleepy during work or spare time', and 'mentally tired'—were analyzed as described by Theorell et al. (12). Each answer to these four questions was graded from 0 to 3, and a high value for the summed score of each patient reflects 'sleep disturbances' leading to tiredness (index, 0–12) (12).

Statistics

Descriptive statistics including a confidence interval (CI) for the mean was used. Differences of means were calculated with 95% CI (13). The CI confirms a significant difference between means when the total interval is either positive or negative and separated from zero. The significance level set was $p < 0.05$.

The rate ratio (RR) and the Greenland–Robins 95% confidence limits (14) were used for a comparison of general musculoskeletal pain/discomfort between the CMD patients and the population sample and also between men and women. The rate ratio was computed as the ratio of the rate of a disease in the exposed persons to the rate of disease in unexposed persons. The 95% CI of the rate ratio suggests a significant difference between exposed and unexposed patients when the lower limit is close to or above 1.0.

The study protocol was approved by the Ethical Committee of Huddinge Hospital, Karolinska Institutet, Stockholm, Sweden.

Results

Among the CMD patients tooth clenching was reported by 60% and grinding of the teeth by 36%. Pain in the temporomandibular joint (TMJ) region was present in 65%. Muscular discomfort or pain was reported by 61% of the patients. The median pain assessment, using Borg's new scale

Table 2. Rates for signs and symptoms of craniomandibular disorders (CMD) among CMD women and CMD men

	CMD women		CMD men		Rate ratio	CI
	Rate	*n*	Rate	*n*	(RR)	(95%)
Clenching the teeth	0.67	55	0.42	24	1.61*	0.97–2.68
Grinding the teeth	0.38	56	0.33	24	1.15	0.59–2.21
TMJ pain	0.70	54	0.50	22	1.41(*)	0.90–2.21
Muscular pain	0.72	53	0.38	24	1.83*	1.07–3.13
Headache	0.36	55	0.48	23	0.76	0.44–1.32

Rate ratios (RR) and 95% confidence limits (CI) are presented for a comparison between sexes. Increased risks are marked * or tendency (*); *n* = number of observations.

(Table 1), was scale level 3 (moderate pain). Strong pain (scale level 5 to 10) was reported by 10 patients for the right side of the face and by 11 patients for the left side. The prevalence of headache during the past 3 months was reported as frequent (every day or a couple of days every week) by 40% of the CMD patients. Headache was reported as rare by 24%. These frequencies are presented as a description of the status of the CMD patients and include both men and women. The rate ratios indicated a greater tendency for CMD women than CMD men to clench their teeth and have muscular pain (Table 2). The CMD women also reported pain in the TMJ region more frequently than the CMD men (Table 2).

The commonest sites for general musculoskeletal pain/discomfort 'during the past 12 months' reported by the CMD patients were the neck (66%), the shoulder/shoulder joint (62%), and the low back (61%). The CMD women had higher rates for general musculoskeletal pain than the women in the population sample, focusing on symptoms 'right now' when answering the questions (Table 3). Sites reported were the neck, the shoulder/shoulder joint, elbow, wrist/hand, thoracic back, and the knee. Differences between CMD men and men in the population sample were uncertain because of wide confidence intervals (Table 3).

A comparison between CMD women and CMD men showed that shoulder pain was more common among the CMD women (RR, 2.3; CI, 0.9–5.6). The women in the population sample showed an increased tendency to neck pain compared with the men in the population sample (RR, 2.2; CI, 1.1–4.2) and pain in the thoracic back (RR, 2.0; CI, 0.9–4.4).

The men with CMD had significantly higher scores for psychologic demands at work than the men in the population sample. The mean value for the score calculated for the men with CMD was 13.2 (CI, 12.0–14.4). For the men in the population sample the mean value was 11.8 (CI, 11.2–12.4) (Table 4). The test of the CI for the difference between means for the psychologic demands at work was significant (CI for difference between means, 0.1–2.7). The corresponding comparison between CMD women and population women did not show a difference. The scores for intellectual discretion and authority over decisions at work were similar among CMD patients and the population (Table 4). The test of the differences between groups for men and women was not statistically significant.

The calculated score for sleeping disturbances among CMD men (index, 0–12) showed a mean value of 5.7 (CI, 4.7–6.6). All except one CMD man answered. The index was significantly higher than that reported for men in the population sample, with a mean value of 4.1 (CI, 3.6–4.6) ($p < 0.05$). There were no differences between CMD women and women in the population sample. Nor did scores for sleeping disturbances differ significantly between CMD women and CMD men.

Table 3. General musculoskeletal pain/discomfort 'right now' compared between women with craniomandibular disorders (CMD) and women from a sample population, and between men with CMD and men from a sample population

	Women							Men					
	CMD		Population					CMD		Population			
	R	*n*	R	*n*	RR	CI		R	*n*	R	*n*	RR	CI
Neck	0.46	50	0.29	79	1.58	1.00–2.49	*	0.26	19	0.13	82	1.96	0.77–4.98
Shoulder	0.50	48	0.26	78	1.95	1.22–3.13	*	0.22	18	0.20	85	1.11	0.42–2.91
Elbow	0.20	35	0.08	83	2.37	0.90–6.26	(*)	0.12	17	0.06	90	2.12	0.90–6.26
Wrist/hand	0.35	37	0.18	82	1.92	1.02–3.62	*	0.12	17	0.12	89	0.95	0.23–3.92
Thoracic back	0.35	40	0.18	83	1.94	1.04–3.61	*	0.17	18	0.09	88	1.83	0.54–6.25
Low back	0.32	41	0.28	79	1.14	0.64–2.02		0.14	21	0.23	87	0.62	0.20–1.90
Hip	0.22	37	0.15	84	1.40	0.63–3.08		0.11	19	0.09	88	1.16	0.27–5.03
Knee	0.34	41	0.14	83	2.36	1.20–4.63	*	0.12	17	0.18	85	0.67	0.17–2.65
Ankle/foot	0.14	35	0.21	82	0.69	0.28–1.72		0.22	18	0.13	89	1.65	0.60–4.53

R = rates for musculoskeletal pain in different parts of the body; *n* = number of observations; RR = rate ratios; CI = 95% confidence limits. Increased risks are marked * or tendency (*).

Table 4. Psychosocial indices based on the demand/control situation at work. A comparison between patients with craniomandibular disorders (CMD) and a random population sample. Separate analyses are made for women and men

	Men		Women	
	CMD	Population	CMD	Population
1. Psychologic demands (possible width of variation, 5–20; a higher score corresponds to more demand at work)				
Mean value	13.2	11.8	12.6	12.2
CI	12.0–14.4	11.2–12.4	11.8–13.4	11.6–12.8
n	23	87	49	81
SD	2.8	2.9	2.8	2.8
	CIA test = CI, 0.1 to 2.7*		CI, −0.6 to 1.4	
2. Intellectual discretion (possible width of variation, 4–16; a higher score corresponds to more stimulation at work)				
Mean value	12.0	12.3	11.2	11.7
CI	11.3–12.7	11.8–12.8	10.5–11.9	11.2–12.2
n	23	86	52	81
SD	1.7	2.4	2.6	2.3
	CIA test = CI, − 1.4 to 0.8		CI, −1.4 to 0.4	
3. Authority over decisions (possible width of variation, 2–8; a higher score corresponds to more authority at work)				
Mean value	6.8	6.7	6.3	6.3
CI	6.4–7.2	6.4–7.0	5.8–6.8	6.0–6.6
n	23	87	51	81
SD	1.0	1.4	1.8	1.4
	CIA test = CI, −0.5 to 0.7		CI, −0.6 to 0.6	

A significant difference between sample means analyzed with the confidence interval analysis (CIA) is marked *. The values for the population samples have been published (5). CI = 95% confidence limits; *n* = number of observations; SD = standard deviation.

Discussion

The CMD patients participating were those consecutively attending the Department of Clinical Oral Physiology at the time of the study. There was a majority of women. Ratios between women and men reported in clinical studies vary from 3:1 (15) up to as high as 9:1 (16). The CMD patients in the present study are considered representative for CMD patients in general with regard to age and sex. The age distribution among the CMD patients and the random population sample was similar.

A previous study on the population sample has shown that the women had a higher prevalence of symptoms than the population sample of men. The ratio was 1.6–2.7 (17). For the CMD women, compared with the population women, the results of this study showed increased risks of musculoskeletal symptoms of the shoulder joint, the thoracic back, and the elbow/forearm. This was in congruence with a previous case–control study on 30 CMD patients (4). However, additional sites in the present study were the neck, the wrist/hand, and the knee. The Nordic questionnaire used is judged to give a fairly good estimation of the prevalence of musculoskeletal pain (18). A larger part of those in a population with pain are found when using the Nordic questionnaire than with pain drawings on a model (18). However, for an individual screening the questionnaire is less suitable, since it is prone to give an overestimation of pain compared with an estimation of pain during a medical interview (18). The calculations of the rate ratios were made for the answer given concerning pain right now. These answers have been found to represent discomfort/pain during the past week. The answer given to the same question for the past 12 months is reported to represent 'sometimes' without a reliable aspect of time (18).

With regard to the signs and symptoms of CMD, the CMD women showed increased rates of tooth clenching and muscular pain compared with the CMD men. Women referred or receiving treatment for CMD seem to have more general symptoms and a greater number of pain locations than CMD men (19). In most studies no significant differences between sexes have been found (20–23). However, in an epidemiologic study of adolescents, more severe and frequent symptoms for girls than boys were reported (24). They were also more polysymptomatic (24).

The increased tendency to shoulder pain found among CMD women compared with CMD men is notable, since these women also show increased tendencies to clench their teeth compared with CMD men. A significantly increased electromyographic activity of the trapezius muscle has been recorded during experimentally increased activity of the masticatory elevator muscles (25, 26).

The CMD men showed increased risks compared with the men in the population sample for psychologic demands at work—that is, having to work very fast and very hard and not have enough time. The work demanded too great an effort, and there were contradictory demands. The reliability of the psychosocial questions evaluated by a product–moment correlation for test–retests of seven questions showed a correlation of 0.77 for psychologic demands (27). The correlation coefficients for intellectual discretion was 0.63, and for authority over decisions 0.55 (27). A limit chosen for acceptance of reliability was 0.60 or higher (27). The main result of the psychosocial part of the present study concerned psychologic demands at work, and the reliability of these questions is therefore high.

The CMD men had more difficulties in awakening, having nightmares, being tired/sleepy during work or spare time, and being mentally tired than a population sample of men. The reliability of these four questions was above the limit of 0.60 set for the coefficient of product–moment correlation (27).

The CMD group differed from the population group both in reporting conflicting psychologic demands at work and in having sleeping disturbances. The women, however, seemed more affected by musculoskeletal symptoms from different parts of the body. The possibility could not be excluded that the cause of the psychosocial problems that the men experienced at work

was the bad sleeping habits, since physiologic tiredness per se could affect the situation at work. However 'the demand/control' situation at work has been documented to correlate strongly with the stress level (5). Sleeping disturbances are correlated with many variables such as conflicts, lack of possibility to talk, rush, and psychologic demands (5). Sleeping disturbances also correlate negatively with positive factors in life (5). Most likely, 'problems at work' affect sleeping habits. Without deciding the direction of the cause and effect between these variables, the stress level was affected more among CMD men than the mean of the population sample. From a stomatognathic point of view these mental stressors should always be considered in the treatment of CMD patients.

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