Association Between Sociodemographic, Behavioral, and Medical Conditions and Signs of Temporomandibular Disorders Across Gender: Results of the Study of Health in Pomerania (SHIP-0)

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Purpose: To examine whether there is a gender-dependent risk profile for signs of temporomandibular disorders (TMD) in a population-based sample. ***Materials and Methods:*** Sociodemographic, behavioral, and medical factors were checked for associations with TMD in a cross-sectional study of 3,567 subjects aged 25 to 74 years in Germany. Data were collected from clinical examinations, interviews, and questionnaires. Logistic regression analyses were used to estimate factors associated with signs of TMD across gender. TMD signs included tenderness or pain on palpation of 3 or more masticatory muscles and tenderness or pain on palpation in 1 or both temporomandibular joints (TMJs). ***Results:*** In women, muscle tenderness or pain was found to be significantly associated with general arthrosis/arthritis and lower back pain. In men, muscle tenderness or pain was significantly associated with school education > 11 years, various categories of loss of occlusal support, lip/tongue/cheek biting, and general arthrosis/arthritis. In women, TMJ tenderness or pain was associated with widowed status, bruxism, general arthrosis/arthritis, lower back pain, and sex-hormone replacement. In men, TMJ tenderness or pain was associated with multiple losses of posterior supporting zones, gout, and lower back pain. In women, there were inverse associations between loss of occlusal support in 3 posterior zones and muscle and TMJ tendernes. ***Conclusion:*** Except for some general health conditions and bruxism, the hypothesis of a gender-dependent risk profile for signs of TMD is partly supported. The results of this study indicate that TMD is a complex disorder associated with mixed etiologic factors between genders. *Int J Prosthodont 2008;21:141–148.*

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Temporomandibular disorders (TMD) is a collective term embracing a number of clinical problems that involve the masticatory musculature, the temporomandibular joint (TMJ) and associated structures, or both.[1] The etiology of TMD is considered to be one of the most controversial issues in clinical dentistry.[2] A multifactorial origin with predisposing, initiating, and perpetuating factors has been widely accepted.[1,2] Predisposing factors include structural (skeletal and occlusal disturbances), systemic (metabolic, hormonal, rheumatic diseases), and psychologic conditions that may increase susceptibility for developing TMD. Initiating factors are direct trauma (macrotrauma) and repetitive adverse loading of the masticatory system as a result of microtrauma or parafunctional habits. Perpetuating factors, such as parafunction, hormonal status, or psychosocial circumstances, can sustain the patient's disorder.[1,2]

Large frequency ranges for TMD signs (30% to 80%) and subjective symptoms (15% to 50%) have been previously described[1,3,4] and attributed to different samples (eg, random versus nonrandom, patient versus nonpatient), different age groups, unequal gender distributions, diverse dependent variables (eg, signs, symptoms, indices, diseases), and various methods of examination.[5] Compared to men, women more often exhibit TMD signs and subjective symptoms.[1,3,4,6,7] The research attributes this higher TMD prevalence in women to biologic (hormonal) and psychosocial circumstances.[7–9] Women may have more susceptible TMJ structures that tend to deteriorate.[10] Based on psychosocial background, men and women differ in their sensitivity to stimuli[8] and are exposed to different levels and types of psychosocial stress.[9] Gender-specific psychosocial conditions (family, occupation, education, behavior) may modulate awareness and expression of pain.[7,11] Thus, it is easier for women than for men to report their experience of pain.[9,12] Another reason for differences between men and women regarding TMD prevalence could be a gender-dependent effect magnitude of extrinsic and intrinsic conditions within the multifactorial origin of TMD. The gender-specific impact of possible risk factors for TMD remains largely unexplained.[1,2]

In previous analyses using data from the Study of Health in Pomerania (SHIP-0), it was shown that along with gender-dependent prevalences of TMD signs and symptoms,[5] significant associations between dental factors such as loss of occlusal support and TMD signs were present exclusively in men.[13] Therefore, the aim of this study was to verify whether there is a gender-dependent risk profile for TMD signs regarding additional psychosocial, behavioral, and medical factors.

Materials and Methods

Study Population

SHIP-0 is a cross-sectional survey of the population in northeast Germany involving the cities of Greifswald, Stralsund, and Anklam and 29 surrounding villages. From the total number of 212,157 people living in the study area, an age- and gender-stratified sample was drawn at random, proportional to each community population size. From County Registry Office files, the study management selected and invited 6,267 people from the net sample (migrated or deceased persons excluded) aged 20 to 81 years. Between October 1997 and May 2001, data were collected under professional conditions in study examination centers in Greifswald and Stralsund. With a response rate of 68.8%, 4,310 subjects were examined. The study was approved by the Ethics Committee of the University of Greifswald, and all participants gave informed written consent.

Data collection consisted of 4 parts: a medical examination, oral health examination, face-to-face interview, and self-administered questionnaire. Details of the study design were reported elsewhere.[14] This study was limited to 3,740 subjects classified into five 10-year age groups ranging from 25 to 74 years.

Data Assessment

Calibrated dental clinicians performed the oral examination, assessing for tooth position, prosthetic status, and dysfunctional signs according to the guidelines of the Academy of Orofacial Pain.[1] Every 6 months, calibration exercises were performed on a subset of persons not connected with the study. For more information regarding the oral examination, see Hensel et al[15] and Gesch et al.[5] In this study, the following TMD signs were evaluated:

1. Tenderness or pain of masticatory muscles (temporalis, masseter, medial pterygoid, suboccipitalis, sternocleidomastoid) by bilateral palpation with 2 lbs of pressure or pain by isometric contraction test of the lateral pterygoid muscle.
2. Tenderness or pain of TMJs by direct preauricular bilateral palpation with 1 lb of pressure or by compression of the joints in the dorsocranial direction.

Remaining occlusal support between antagonistic jaws was classified according to the Eichner index.[16] The Eichner classification is based on 2 occlusal contact areas—1 in the premolar region and 1 in the molar region—on each side, including fixed partial dentures. Class A contains all 4 support zones. Class B contains 3 (B1), 2 (B2), or 1 (B3) support zone(s) or support in the frontal area only (B4). In Class C, there are no antagonist contacts between the maxilla and the mandible.

The dental interview was conducted by 2 trained dental nurses and included questions regarding the presence or absence of the following: awake and/or sleep grinding and/or clenching the teeth (ie, awake/sleep bruxism), gum chewing, lip/tongue/cheek biting, and chewing mostly on one side (ie, unilateral chewing).

The sociodemographic data were taken from the interview. Educational level was categorized into 3 groups: $<$ 10 years of school, 10 to 11 years of school (reference group), and $>$ 11 years of school. Additionally, marital status (married [reference group], married but separated, single, divorced, widowed) and unemployment were recorded.

Certain chronic diseases during the past year were registered from the medical history of the interview: osteoporosis, gout, and lower back pain. Various types

of arthritis, such as chronic polyarthritis and arthrosis in hip, knee, foot, or shoulder joints, were summarized into a single variable: general arthrosis/arthritis. Women were asked whether they took oral contraceptives and whether they had undergone hormone replacement therapy in the past, ie, use of exogenous sex hormones.

Statistical Analyses

Data on qualitative characteristics were expressed as absolute numbers and as percentages. Comparisons between groups were made using the Fisher exact test in the case of 2 × 2 tables and comparisons to a reference group using the logistic regression analysis in the case of n × 2 tables. For nominal variables, the *P* values of global tests are given.

For the first analysis, subjects with tenderness or pain of 3 or more masticatory muscles were assessed as cases, and for the second analysis, subjects with tenderness or pain of 1 or both TMJs were assessed as cases. Putative risk markers were prespecified and analyzed in logistic regression models. To include these preselected variables for use in multivariable analyses, the method recommended by Sun et al[17] was applied. This automated selection procedure is based on the reports from simulation studies and comprises the use of various stopping rules, setting the *P* value from .15 to .25 for entering variables into the model and from .10 to .15 for deleting variables. Additional sensitivity analyses were performed in nonautomated selection procedures, taking different sets of independent variables for use in multivariable analyses and by considering *P* value functions or confidence intervals (CIs).[18] There were no substantial differences in these analyses compared to the findings presented. The odds ratios (ORs) with 95% CIs were calculated for women and men separately. A value of $P \leq .05$ was considered statistically significant. All analyses were performed with SPSS 11.5 software (SPSS).

Results

Baseline Characteristics

Of the 3,740 subjects aged 25 to 74 years, the records of 95 women (5.0%) and 78 men (4.3%) were excluded because no TMD examinations were performed (n = 10) or various anamnestic data were missing. Thus, 3,567 subjects remained for further analyses.

Men were slightly older (50.8 ± 14.1 versus 49.1 ± 13.7 years; $P < .001$). Tenderness or pain of 3 or more masticatory muscles was found in 5.2% of the 1,820 women and in 1.4% of the 1,747 men. Tenderness or pain of 1 or both TMJs occurred in 8.2% of the women and in 3.5% of the men. Thirty-four women (1.9%) and 9 men (0.5%) had tenderness or pain of both muscles and TMJs. More men than women had less than 10 years of school education (40.9% vs 36.4%; $P < .001$) and more than 11 years of school education (17.2% vs 14.3%; $P = .020$). Most of the participants were married (66.3% of the women, 72.8% of the men).

The characteristics of subjects regarding muscle tenderness or pain are presented in Table 1, and the characteristics of subjects regarding TMJ tenderness or pain are presented in Table 2. Men with loss of occlusal contact areas were more likely to have muscle tenderness or pain than women. Anamnestic bruxism was found more frequently in subjects with TMJ tenderness or pain. Women who reported biting their lips, tongue, or cheeks were more likely to demonstrate TMJ tenderness, whereas men who reported this habit were more likely to demonstrate muscle tenderness. Men who chewed gum showed less TMJ tenderness. Men reported gout more frequently than women (6.5% vs 3.6%; $P < .001$). Men suffering from gout tended to have TMJ tenderness more frequently. Subjects with arthrosis and/or arthritis of other joints (29% of the women, 24.3% of the men) and subjects with self-reported lower back pain (39.9% of the women, 37.1% of the men) were more likely to have muscle tenderness and TMJ tenderness.

Logistic Regression Analyses

For better comparisons between the 2 TMD signs and between genders, variables that proved to be significant in at least 1 multivariable logistic regression analysis were included in all 4 multivariable logistic regression analyses, independent of significance (Tables 3 and 4). The following variables did not meet the selection criteria for inclusion into the model: unemployment, unilateral chewing, gum chewing, and osteoporosis. Regarding "the danger of using statistical significance as the primary basis for inference," as explained by Rothman and Greenland,[18] the possibly large effect within women of "married but separated" (95% CI: 0.97 to 9.53) on muscle tenderness should also be considered because of its *P* value function. For the present low prevalences (< 10%), the ORs do approximately correspond to the relative risk of having a TMD sign, which is defined by the proportion of the disease rate of exposed participants to the disease rate of unexposed participants, eg, the likelihood to have muscle tenderness or pain is about 3 times higher among subjects with general arthritis/arthrosis than among subjects without this condition (Table 3).

In women, muscle tenderness or pain was found to be significantly associated with general arthrosis/arthritis and lower back pain. In men, muscle tenderness or pain was found to be significantly associated with

Table 1 Characteristics of Women and Men Regarding Absence/Presence of Tenderness or Pain of 3 or More Muscles

	Women (n = 1,820)			Men (n = 1,747)		
	Absent (n = 1,726) (%)	Present (n = 94) (%)	*P**	Absent (n = 1,722) (%)	Present (n = 25) (%)	*P**
Age group (y)			.177†			.999†
25–34 (reference)	346 (20.0)	26 (27.7)		309 (17.9)	4 (16.0)	
35–44	364 (21.1)	13 (13.8)	.032	347 (20.2)	5 (20.0)	.874
45–54	368 (21.3)	16 (17.0)	.094	320 (18.6)	5 (20.0)	.781
55–64	379 (22.0)	25 (26.6)	.653	395 (22.9)	6 (24.0)	.806
65–74	269 (15.6)	14 (14.9)	.282	351 (20.4)	5 (20.0)	.887
Education (y)			.086†			.155†
< 10	626 (36.3)	36 (38.3)	.271	706 (41.0)	9 (36.0)	.772
10–11 (reference)	859 (49.8)	38 (40.4)		723 (42.0)	8 (32.0)	
> 11	241 (14.0)	20 (21.3)	.028	293 (17.0)	8 (32.0)	.074
Marital status			.207†			.442†
Married (reference)	1,150 (66.6)	57 (60.6)		1,257 (73.0)	15 (60.0)	
Married but separated‡	36 (2.1)	4 (4.3)	.138	20 (1.2)	0 (0.0)	
Single	209 (12.1)	17 (18.1)	.084	283 (16.4)	5 (20.0)	.451
Divorced	164 (9.5)	10 (10.6)	.557	113 (6.6)	3 (12.0)	.212
Widowed	167 (9.7)	6 (6.4)	.462	49 (2.8)	2 (8.0)	.109
Being unemployed	251 (14.6)	16 (17.0)	.548	227 (13.2)	3 (12.0)	1.000
Eichner Class			.406†			.088†
A (reference)	817 (47.3)	50 (53.2)		832 (48.3)	6 (24.0)	
B1	197 (11.4)	14 (14.9)	.633	185 (10.7)	2 (8.0)	.622
B2	140 (8.1)	6 (6.4)	.420	136 (7.9)	3 (12.0)	.117
B3	109 (6.3)	1 (1.1)	.062	116 (6.7)	4 (16.0)	.017
B4	127 (7.4)	6 (6.4)	.559	102 (5.9)	4 (16.0)	.010
C	336 (19.5)	17 (18.1)	.509	351 (20.4)	6 (24.0)	.137
Unilateral chewing	914 (53.0)	49 (52.1)	.916	670 (38.9)	8 (32)	.541
Awake/sleep bruxism	482 (27.9)	34 (36.2)	.099	520 (30.2)	9 (36.0)	.517
Lip/tongue/cheek biting	210 (12.2)	13 (13.8)	.628	98 (5.7)	5 (20.0)	.013
Gum chewing	785 (45.5)	43 (45.7)	1.000	684 (39.7)	6 (24.0)	.148
Gout	61 (3.5)	5 (5.3)	.386	111 (6.4)	2 (8.0)	.674
Osteoporosis‡	125 (7.4)	7 (8.3)	.673	28 (1.7)	0 (0.0)	
General arthrosis/arthritis	479 (27.8)	48 (51.1)	< .001	413 (24.0)	11 (44.0)	.032
Lower back pain	655 (37.9)	53 (56.4)	< .001	639 (37.1)	10 (40.0)	.836
Use of exogenous hormones	697 (40.4)	45 (47.9)	.162			

*Fisher exact test in the case of 2 × 2 tables and comparisons to a reference group using logistic regression analysis in the case of n × 2 tables.
†Global test for nominal variables.
‡Bivariable test is lacking among men since none showed tenderness or pain of 3 or more muscles.

school education > 11 years, various categories of loss of occlusal support, lip/tongue/cheek biting, and general arthrosis/arthritis.

In women, TMJ tenderness or pain was associated with widowed status, bruxism, general arthrosis/arthritis, lower back pain, and hormone replacement. In men, TMJ tenderness or pain was associated with multiple loss of posterior supporting zones, gout, and lower back pain. In women, there were inverse associations between loss of occlusal support in 3 posterior zones and muscle tenderness and TMJ tenderness.

Discussion

In this population-based study, a number of extrinsic and intrinsic factors were found to be associated with TMD signs. The hypothesis that the effect magnitude of these associations differed with gender was confirmed for school education, marital status, occlusal support, and lip/tongue/cheek biting. Furthermore, the results are the first population-based indications suggesting associations between TMJ tenderness and gout exclusively in men and between TMJ tenderness and sex hormone replacement in women. Other medical conditions such as general arthrosis/arthritis or lower back pain were gender independent with respect to TMD signs.

The relation of highly educated men (95% CI: 1.12 to 9.55) with muscle tenderness may be explained by the harmful effect of high stress levels on health.[8] It is likely that this population group is especially exposed to increased mental strain in the workplace, which has been found to be associated with musculoskeletal pain conditions.[8] Another possible explanation for this finding could be the better self-perception of pain in this group compared with less educated subjects.[12] The significant relation of widowed women to TMJ tenderness (95% CI: 1.01 to 3.66) and the possible moderate

Table 2 Characteristics of Women and Men Regarding Absence/Presence of Tenderness or Pain of 1 or Both TMJs

	Women (n = 1,820)			Men (n = 1,747)		
	Absent (n = 1,671) (%)	Present (n = 149) (%)	*P**	Absent (n = 1,686) (%)	Present (n = 61) (%)	*P**
Age group (y)			.056†			.931†
25–34 (reference)	328 (19.6)	44 (29.5)		301 (17.9)	12 (19.7)	
35–44	347 (20.8)	30 (20.1)	.078	338 (20.0)	14 (23.0)	.924
45–54	358 (21.4)	26 (17.4)	.018	314 (18.6)	11 (18.0)	.761
55–64	372 (22.3)	32 (21.5)	.069	387 (23.0)	14 (23.0)	.808
65–74	266 (15.9)	17 (11.4)	.013	346 (20.5)	10 (16.4)	.460
Education (y)			.388†			.458†
< 10	614 (36.7)	48 (32.2)	.422	693 (41.1)	22 (36.1)	.713
10–11 (reference)	822 (49.2)	75 (50.3)		706 (41.9)	25 (41.0)	
> 11	235 (14.1)	26 (17.4)	.421	287 (17.0)	14 (23.0)	.348
Marital status			.382†			.975†
Married (reference)	1,117 (66.8)	90 (60.4)		1,227 (72.8)	45 (73.8)	
Married but separated	34 (2.0)	6 (4.0)	.086	19 (1.1)	1 (1.6)	.728
Single	206 (12.3)	20 (13.4)	.471	278 (16.5)	10 (16.4)	.957
Divorced	157 (9.4)	17 (11.4)	.287	112 (6.6)	4 (6.6)	.960
Widowed	157 (9.4)	16 (10.7)	.409	50 (3.0)	1 (1.6)	.553
Being unemployed	241 (14.4)	26 (17.4)	.333	223 (13.2)	7 (11.5)	.848
Eichner Class			.144†			.578†
A (reference)	783 (46.9)	84 (56.4)		811 (48.1)	27 (44.3)	
B1	193 (11.5)	18 (12.1)	.607	182 (10.8)	5 (8.2)	.697
B2	134 (8.0)	12 (8.1)	.575	135 (8.0)	4 (6.6)	.830
B3	106 (6.3)	4 (2.7)	.044	116 (6.9)	4 (6.6)	.949
B4	127 (7.6)	6 (4.0)	.058	99 (5.9)	7 (11.5)	.085
C	328 (19.6)	25 (16.8)	.149	343 (20.3)	14 (23.0)	.544
Unilateral chewing	873 (52.2)	90 (60.4)	.060	654 (38.8)	24 (39.3)	1.000
Awake/sleep bruxism	457 (27.3)	59 (39.6)	.002	503 (29.8)	26 (42.6)	.046
Lip/tongue/cheek biting	195 (11.7)	28 (18.8)	.018	96 (5.7)	7 (11.5)	.086
Gum chewing	753 (45.1)	75 (50.3)	.230	674 (40.0)	16 (26.2)	.033
Gout	60 (3.6)	6 (4.0)	.818	105 (6.2)	8 (13.1)	.055
Osteoporosis	122 (7.5)	10 (7.1)	1.000	27 (1.6)	1 (1.6)	1.000
General arthrosis/arthritis	464 (27.8)	63 (42.3)	< .001	404 (24.0)	20 (32.8)	.128
Lower back pain	633 (37.9)	75 (50.3)	.004	615 (36.5)	34 (55.7)	.003
Use of exogenous hormones	667 (39.9)	75 (50.3)	.015			

*Fisher exact test in the case of 2 × 2 tables and comparisons to a reference group using logistic regression analysis in a case of n × 2 tables.
†Global test for nominal variables.

to strong risk of women who are married but living separately (95% CI: 0.97 to 9.53) for muscle tenderness could also indicate a psychosocial component of orofacial pain.[1,7–9] In the psychosocial literature, the association between unmarried status and poorer health was mentioned[19]; further, it was reported that women suffer prior to a divorce, while men suffer afterward.[20] A further reason for the effect of marital status only in women could be that "gender differences should not only be viewed in a single sphere (only hormones or only social), but they should be viewed more globally."[11]

The significantly increased OR of TMJ tenderness among women taking oral contraceptives or having hormone replacement therapy may confirm the suggested effect of female hormones on the TMJ complex. More estrogen receptors in the TMJ were found in women with TMD than in asymptomatic subjects.[21] Animal experiments with rats demonstrated an effect of sex hormones on the collagen and protein content of TMJ discs.[22] Many pain disorders have been reported to fluctuate with the menstrual cycle,[23] and clinical studies indicated a higher risk of TMD among women using various forms of exogenous hormones.[24]

Occlusal support was repeatedly included in the present analyses for a direct comparison of the effect magnitude (OR) between dental and nondental conditions. In agreement with our previous study,[13] the current analyses showed strong associations between loss of occlusal contact areas and muscle tenderness and TMJ tenderness, but only among men. The results confirm the suggestion that if all posterior support is unilaterally or bilaterally missing, the TMD risk seems to increase.[25] In women, a reduced number of supporting zones showed an inverse relationship to both TMD signs, which is in stark contrast to men. The reason for the difference remains unclear.[13] The impact of other factors may be more important in the development of TMD signs among women.

Table 3 Odds Ratios (OR), 95% Confidence Intervals (CI), and *P* Values of Women and Men Regarding Tenderness or Pain of 3 or More Muscles

	Women			Men		
	OR	95% CI	*P*	OR	95% CI	*P*
Age group (y)			.124*			.814*
25–34 (reference)	1.00			1.00		
35–44	0.44	0.21–0.92	.030	0.83	0.15–4.60	.829
45–54	0.39	0.18–0.85	.017	0.69	0.11–4.25	.688
55–64	0.49	0.21–1.17	.109	0.48	0.06–3.59	.474
65–74	0.42	0.15–1.17	.098	0.33	0.04–2.77	.306
Education (y)			.172*			.026*
< 10	1.32	0.69–2.52	.393	0.82	0.27–2.54	.736
10–11 (reference)	1.00			1.00		
> 11	1.76	0.97–3.20	.062	3.26	1.12–9.55	.031
Marital status			.248*			.445*
Married (reference)	1.00			1.00		
Married but separated†	3.05	0.97–9.53	.055	–	–	–
Single	1.45	0.77–2.74	.249	1.58	0.40–6.25	.515
Divorced	1.27	0.62–2.60	.511	2.00	0.52–7.74	.316
Widowed	0.72	0.29–1.82	.490	2.90	0.59–4.20	.189
Eichner Class			.252*			.023*
A (reference)	1.00			1.00		
B1	1.22	0.63–2.37	.547	2.54	0.44–14.72	.297
B2	0.61	0.24–1.53	.292	6.10	1.22–30.47	.028
B3	0.13	0.02–0.98	.047	11.12	2.33–53.43	.003
B4	0.68	0.26–1.79	.439	13.05	2.68–63.40	.001
C	0.69	0.33–1.44	.324	8.36	1.69–41.30	.009
Awake/sleep bruxism	1.38	0.88–2.17	.157	0.95	0.39–2.32	.914
Lip/tongue/cheek biting	0.90	0.47–1.71	.740	5.16	1.60–16.61	.006
Gout	1.09	0.41–2.91	.866	1.18	0.24–5.72	.839
General arthrosis/arthritis	3.08	1.85–5.12	< .001	2.65	1.08–6.47	.032
Lower back pain	1.97	1.21–3.22	.006	0.79	0.32–1.94	.611
Use of exogenous hormones	1.22	0.79–1.90	.371			
Intercept	0.04		< .001	< .01		< .01

*Global test for nominal variables.
†Among men, no cases of tenderness or pain of 3 or more muscles.

The present analyses demonstrated significant associations between anamnestic bruxism and TMJ tenderness in women. However, the ORs and the 95% CIs do not substantially differ from those of men, suggesting an association independent of gender, which verifies the findings of other authors.[7,10,26,27] Contrary to these results, some reports found little evidence that bruxism is of etiologic significance to TMD.[28,29] Nevertheless, similar associations between lip/tongue/cheek biting and muscle tenderness in men may be indications that TMD results from stress-induced muscular hyperactivity.[1]

Gouty arthritis is the most common form of inflammatory joint disease in men over 40 years of age.[30] In the present study, the frequency of self-reported gout was almost twice as high among men than among women, and a relation to TMJ tenderness was seen only in men. This finding is contrary to those of Gross et al,[31] who reported that gout and pseudogout rarely have an effect on the TMJ. Furthermore, anamnestic arthrosis and/or arthritis and lower back pain were associated with TMD signs in both men and women. Pain of the masticatory system is often related to pain conditions elsewhere in the body, eg, lower back pain or pain of the cervical spine and the surrounding musculature.[32] TMD and benign back pain share some features, such as psychologic distress, somatization, and depression found in chronic pain illness.[32,33] It is possible that both kinds of pain coexist independently because of a common origin. On the other hand, one disorder may have causal significance for the other, and TMD pain is a symptom of general conditions.

Some aspects of these analyses should be viewed in terms of considerations inherent to epidemiologic studies regarding TMD. Because data were cross sectional, the results must be interpreted with caution. Another limitation is the lack of objective data for the general medical history and oral parafunctions. Further parameters for bruxism, such as tooth wear or observations in sleep laboratories, could not be considered in this cross-sectional study design. The 2 dependent variables were signs of several TMD diseases, since definitive diagnoses cannot be determined in epidemiologic stud-

Table 4 Odds Ratios (OR), 95% Confidence Intervals (CI), and *P* Values of Women and Men Regarding Tenderness or Pain of 1 or Both TMJs

	Women			Men		
	OR	95% CI	*P*	OR	95% CI	*P*
Age group (y)			.012*			.273*
25–34 (reference)	1.00			1.00		
35–44	0.59	0.34–1.02	.057	0.74	0.29–1.88	.523
45–54	0.37	0.20–0.68	.001	0.48	0.17–1.35	.165
55–64	0.36	0.18–0.73	.004	0.38	0.12–1.19	.098
65–74	0.27	0.11–0.65	.003	0.26	0.07–0.91	.036
Education (y)			.683*			.283*
< 10	1.07	0.63–1.83	.795	0.86	0.42–1.73	.663
10–11 (reference)	1.00			1.00		
> 11	1.24	0.76–2.04	.386	1.55	0.77–3.12	.218
Marital status			.097*			.905*
Married (reference)	1.00			1.00		
Married but separated	2.21	0.86–5.66	.098	1.45	0.18–11.49	.723
Single	0.87	0.50–1.52	.631	0.80	0.33–1.92	.620
Divorced	1.41	0.80–2.48	.231	0.76	0.25–2.28	.626
Widowed	1.93	1.01–3.66	.045	0.48	0.06–3.77	.488
Eichner Class			.349*			.110*
A (reference)	1.00			1.00		
B1	0.94	0.54–1.66	.838	1.01	0.37–2.79	.982
B2	0.84	0.43–1.66	.623	1.14	0.37–3.53	.814
B3	0.34	0.12–0.98	.046	1.75	0.55–5.55	.344
B4	0.50	0.20–1.26	.144	3.57	1.34–9.50	.011
C	0.77	0.42–1.42	.402	2.73	1.11–6.74	.029
Awake/sleep bruxism	1.66	1.16–2.37	.006	1.54	0.90–2.66	.116
Lip/tongue/cheek biting	1.26	0.79–2.02	.331	1.82	0.76–4.34	.178
Gout	0.96	0.39–2.37	.929	2.31	1.02–5.23	.045
General arthrosis/arthritis	2.48	1.64–3.75	< .001	1.26	0.70–2.29	.437
Lower back pain	1.75	1.19–2.57	.005	2.23	1.28–3.91	.005
Use of exogenous hormones	1.46	1.02–2.08	.038			
Intercept	0.07		< .001	0.02		< .001

*Global test for nominal variables.

ies such as this.[1,3–5] Summaries of signs and symptoms as indices are unspecific.[28] These are reasons for using separate analyses with 2 subclinical endpoints, namely, muscle tenderness and TMJ tenderness. In contrast to our first report,[13] the criterion for defining a case of muscle tenderness/pain was changed from 1 or more muscle sites with tenderness to at least 3 muscle sites according to the Research Diagnostic Criteria for TMD.[1] This fact should increase the ability of this analysis to identify significant, stable risk indicators.

This study has several strengths. First, subjects were drawn at random from official inhabitant data files and stratified by age and gender. Therefore, and because the comparison group and the case group originate from the same population base, it was possible to minimize selection bias. Second, various independent variables allowed complex analyses in terms of comorbidity and risk factor combinations for TMD.[15] Third, use of the inclusion method of Sun et al[17] instead of the inappropriate use of bivariable selection is to be emphasized. This method avoids selection of noise variables and is recommended to maximize the proportion of the authentic variables. Thus, it could reasonably be assumed that this study has assessed a high proportion of variables that are relevant for comparing the profiles of men and women.

Conclusion

The hypothesis of a gender-dependent risk profile for temporomandibular disorder signs is partly supported by the present study. Several other behavioral, medical, and psychosocial risk indicators for temporomandibular disorders were identified; however, except for some general health conditions and bruxism, they were different in women and men. The findings suggest that loss of occlusal support in men seems to have more impact on the development of temporomandibular disorder signs than in women. The results of this study indicate that temporomandibular disorder is a complex disorder associated with mixed etiological factors between genders.

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