Associations between social and general health factors and symptoms related to temporomandibular disorders and bruxism in a population of 50-year-old subjects

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Johansson A, Unell L, Carlsson GE, Söderfeldt B, Halling A, Widar F. Associations between social and general health factors and symptoms related to temporomandibular disorders and bruxism in a population of 50-year-old subjects. Acta Odontol Scand 2004;62:231–237. Oslo. ISSN 0001-6357.

The aim of this epidemiological study was to examine associations between temporomandibular (TMD)-related problems and variables from three domains: (1) socio-economic attributes, (2) general health and health-related lifestyle, and (3) dental attitudes and behaviors. The overall response rate to a questionnaire mailed to the total population of 50-year-old subjects in two Swedish counties (8,888 individuals) was 71%. Among the 53 questions in the questionnaire, those related to social, general health, and health-related factors were used as independent variables in logistic regression models. Three TMD-related symptoms and reported bruxism were used as dependent variables. Impaired general health was the strongest risk factor for reported TMD symptoms. Along with female gender and dissatisfaction with dental care, impaired general health was significantly associated with all three TMD symptoms. A few more factors were associated with pain from the TMJ only. In comparison, reported bruxism showed more significant associations with the independent variables. In addition to the variables associated with TMD symptoms, being single, college/university education, and daily tobacco use were also significantly correlated with bruxism. Besides female gender, impaired general health, dissatisfaction with dental care, and a few social and health-related factors demonstrated significant associations with TMD symptoms and reported bruxism. □ *Epidemiology; impaired general health; logistic regression; questionnaire study; socio-economic factors*

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The etiology of temporomandibular disorders (TMDs) is not well known and is considered complex (1, 2). Since TMDs comprise a number of disorders and conditions in the orofacial region, it is evident that many etiological factors may be involved (3). The belief that occlusal factors had a dominating role in the etiology of TMD has been abandoned (4), and the previously often suggested role of bruxism in TMD development has also been questioned (5, 6).

The importance of psychosocial factors has been emphasized increasingly during the past few decades. In clinical and case-control studies it has been found, for example, that many TMD patients are in a 'poor social situation', they are less well socially integrated, they have increased levels of stress, anxiety and depression, and they often have sleep disturbances, somatic complaints, and impaired general health (7–16).

In line with the long history of controversy regarding TMD etiology, there are also studies with conflicting results that do not corroborate a significant relationship between TMD and psychosocial factors (17, 18). However, recent literature reviews have in general acknowledged a strong relationship between psychosocial factors and TMD, at any rate in subgroups of TMD patients, which suggests that a multidisciplinary perspective is required both in the assessment and management of TMD (3, 19). An extensive review of the epidemiology of TMD highlights the still prevailing controversies and the need for further research on etiological factors associated with TMD, and points to the potential of epidemiological studies (20). The etiology of bruxism has also been controversial; theories have included occlusal, psychological, genetic, and stress factors (21–23). Bruxism has recently been defined as a sleep disturbance and movement disorder, and the literature on sleep bruxism is rapidly growing (24).

In 1992, oral health attitudes to dental care as well as experiences of dental care were evaluated among all 50-year-old subjects in the Swedish counties of Örebro and Östergötland. The study aimed to serve as a basis for planning Public Dental Health resources (25). Part of the investigation focused on signs and symptoms related to TMD and bruxism and forms the basis for this paper, as it did for an analysis of gender differences in such symptoms in the sample examined (26). In that study it was demonstrated that women, more often than men, reported

pain from the temporomandibular joints (TMJs), TMJ sounds, bruxism, sensitive teeth, and burning mouth symptoms.

The aim of the present study was to examine associations between TMD-related problems and bruxism and variables from three domains: (1) socio-economic attributes, (2) general health and health-related lifestyle, and (3) dental attitudes and behaviors. It was hypothesized that social and general health factors have an influence on the prevalence of these symptoms.

Materials and methods

Population and response rate

In 1992, a questionnaire was sent to all 50-year-olds in two counties in Sweden, Örebro and Östergötland, i.e. altogether 8,888 persons. The final response rate was 71.3% (6,343 persons), the same rate in both counties. Details of the procedures have been reported elsewhere (25, 27). In this study, only those who answered the questions about pain stemming from the TMJ and bruxism were analyzed. Due to some internal non-response they were 6,043 (68.0% of the population). Gender was the only variable that allowed representativity of the respondents to be controlled. There was no significant difference ($\chi^2 = 0.58$, 1 d.f.; $P > 0.05$) in the gender composition of the respondents compared to the non-respondents.

Questionnaire

The questionnaire, comprising 53 questions with a total of 123 items, was designed in six different sections: 1) general socio-economic conditions (e.g. age, gender, occupation), 2) general health (e.g. physician visits, tobacco habits, drug consumption), 3) oral conditions (e.g. satisfaction with teeth, oral problems, oral hygiene habits, number of teeth), 4) a series of attitude questions concerning function and appearance of teeth, 5) experience and use of dental care, and 6) most recent visit to a dentist.

Data registration

Data were recorded by dental personnel. Clinical examination was performed in a randomly selected subgroup of the total sample (457 men and 484 women) to validate and quantify the responses regarding reported number of remaining teeth and jaw opening capacity. There was good congruence between self-reports and clinical registrations, and the level of congruence did not differ significantly between men and women (28). The complete questionnaire design has been described previously (25).

Statistical methods

All statistical analyses were performed using the Statistical Package for Social Sciences (SPSS, Release 10.0) on an IBM personal computer. Logistic regression models were used, and dummy variables were calculated for categorical independent variables (29).

Dependent variables: The following four dependent variables were used: Pain from TMJ, difficulty in opening the mouth, TMJ sounds, and bruxism (grinding or clenching the teeth). The response alternatives were: 'no problems', 'some problems', 'rather many problems', and 'great problems'. All three questions were dichotomized with no problems set as 0 and all others as 1.

Independent variables: The independent variables in this study can be divided into 'social factors', 'general health and health-related factors', and 'dental attitudes and behaviors'. The variables in the questionnaire, response alternatives and their dichotomizations forming the basis for the distributional analysis are given in Table 1. 'Residence' was included as dummy variable with city as reference category. 'Occupation' was an open-ended question, augmented with a subquestion about entrepreneur or otherwise. Occupation was categorized based on the one-digit level of the Socio-Economic Index (SEI). This is the official occupational classification of Statistics, Sweden. The four categories, 1) blue-collar workers, 2) white-collar workers, 3) professionals and white-collar workers in leading positions, and 4) entrepreneurs and farmers, were included in the models as three dummy variables with 'blue-collar workers' as reference category. 'Working hours' was included as dummy variable with full time as reference category. 'Education' was included as dummy variable with primary education as reference category.

Regarding 'general health and health-related lifestyle factors', there was one question on general health and two questions on tobacco use. The general health question inquired as to whether the respondents considered themselves absolutely healthy, generally healthy, not so healthy, or absolutely not healthy. The responses were dichotomized into 1) absolutely and generally healthy and 2) remaining. 'Smoking' included smoking and/or use of smokeless tobacco and was dichotomized into two categories, daily use of tobacco or not.

Regarding 'dental attitudes and behaviors', there were four groups of attitudes included in the models: 1) Dental appearance, 2) Dental function. For these two indicators, dichotomies were used, with the highest category indicating high importance of appearance and function versus the remaining. 3) Satisfaction with dentist as a general question about their perception of received care. The variable was dichotomized with high satisfaction versus all others. 4) 'Utilization of dental care' was indicated by a question on frequency of visits combined with a question on expenses last year and a question regarding when the last dental visit took place. The questions were combined into an index contrasting those with high utilization with others (more than one visit a year and expenses over SEK 1000 last year versus all others, and last visit to a dentist less than a year ago versus all others).

Results

Several significant associations were found in the bivariate analyses between the dependent variables, TMD symptoms and bruxism, and the independent variables related to socio-economic attributes, general health and health-related lifestyle, dental attitudes and behaviors (Table 2). Logistic regression analysis demonstrated that among the tested independent variables (Table 1) poor/impaired general health ('sick') was the strongest risk factor for reported pain from the TMJ region, with an odds ratio (OR) of 2.24 (Table 3). Other factors associated with a significantly increased risk for pain from the TMJ were: being dissatisfied with dental care, being a white collar worker, high utilization of dental care, and female gender (Table 3). Being born outside Sweden was close to being significantly associated with pain from the TMJ ($P = 0.07$). The two dependent variables (difficulty in opening the mouth and TMJ sounds) were both significantly associated with impaired general health, being dissatisfied with dental care, and female gender (Table 3). Among the four dependent variables, reported bruxism had most significant associations with the independent variables. Increased risk to report bruxism was found in subjects with the following characteristics: dissatisfaction with dental care, poor general health, daily tobacco use, white-collar work, college/university education, high utilization of dental care, not married/single, considering dental function very important, and female (Table 3).

The logistic regression analyses revealed no significant associations between any of the three dependent variables consisting of TMD symptoms and the following independent variables: marital status, residence, born outside Sweden, working hours, education, dental appearance, and dental function. The dependent variable bruxism, however, was significantly associated with several of these independent variables (Table 3).

Table 1. Questions and response alternatives in the questionnaire. 'Ref' indicates the reference category in the dummy variable

Question regarding:	Response alternatives
Marital status	1) married/cohabiting; 2) single
Gender	1) men; 2) women
Residence	1) city (Ref); 2) town; 3) rural
Born outside Sweden	1) yes; 2) no
Occupation	1) blue-collar workers (Ref); 2) white-collar workers, 3) professionals/white-collar workers in leading positions; 4) entrepreneurs and farmers
Working hours	1) full time >35 h/week (Ref); 2) part time 1–34 h/week; 3) none
Education	1) primary education (Ref); 2) secondary education; 3) college/university education
General self-perceived health	1) healthy; 2) remaining
Smoking	1) daily; 2) not daily
Dental appearance	1) very important; 2) remaining
Dental function	1) very important; 2) remaining
Satisfaction with dentist	1) satisfied; 2) remaining
Utilization of dental care	1) high utilization; 2) remaining

Discussion

Among the variables analyzed in this study, perceived general health was more strongly associated with the three dependent variables related to TMD symptoms (pain from TMJ region, TMJ sounds, and difficulty in opening the mouth) than the social variables were. As expected, female gender was associated with increased risk of reporting TMD symptoms as a consequence of the higher prevalence of such symptoms among the women found in this population sample (26) as well as in several recent studies (20, 30). However, marital status, residence, working hours, and education did not show any significant association with TMD symptoms (Table 3). Those born outside Sweden reported significantly more TMJ pain than Swedish-born persons according to the bivariate analyses (Table 2), but in the logistic regression model it was not included among the significant variables ($P = 0.07$). Besides gender, only one significant correlation to a social factor was found: white-collar workers reported TMJ pain more often than workers.

There have been only a few studies of the socio-economic characteristics of TMD patients, and with conflicting results. Two early studies observed a clear overrepresentation of subjects belonging to the middle and upper social classes in their patient series (31, 32), but this could not be verified in a Swedish study (33). In the latter study of 350 consecutive TMD patients, those who were in a 'poor social situation' reported more severe local and general symptoms. In a population study (34), TMD symptoms were reported in lower frequency in persons with higher education than in those with lower. However, a significant difference was found for young women with lower education who had more TMD symptoms than others. It was concluded that the association between education and TMD symptoms was much weaker than between education and dental status.

There is currently an emphasis on the importance of the psychological domain of psychosocial factors in TMD, as described in this paper. In particular, stress factors and depression have been highlighted (16, 19). In the present epidemiologic sample, such psychological aspects could not be analyzed because they were not included in the study design (in the questionnaire).

Impaired self-perceived general health was a significant risk factor for reporting the three TMD symptoms. Significant correlations between TMD symptoms and impaired general health and 'general symptoms' (= multiple somatic symptoms) were demonstrated already in an early epidemiologic TMD study (35). A relationship between general somatic symptoms and TMD symptoms have been reported in a more recent study of an epidemiologic character (36). A prospective study of onset

Table 2. Frequency distribution of TMD symptoms in variables related to socio-economic attributes, general health and health-related lifestyle, and dental attitudes and behaviors. The *P* value denotes the significance level (Pearson chi-square test)

	TMJ pain (%)	*P*	Difficulty open (%)	*P*	TMJ sounds (%)	*P*	Reported bruxism (%)	*P*
Marital status								
Married/cohabiting	9.1	<0.05	9.7	NS	14.4	NS	17.6	<0.05
Single	11.5		11.2		15.7		20.8	
Gender								
Men	6.7	<0.001	8.4	<0.001	12.4	<0.001	15.8	<0.001
Women	12.4		11.4		16.9		20.6	
Place of birth								
Sweden	9.2	<0.001	9.8	NS	14.7	NS	18.3	NS
Outside	14.9		11.8		14.2		16.4	
Residence								
City	9.6	NS	9.9	NS	14.6	<0.05	18.6	NS
Town	9.0		9.3		13.5		18.3	
Rural	10.5		10.9		16.9		16.9	
Occupational status								
White-collar workers—leading positions	7.5	<0.01	8.4	NS	14.2	NS	20.2	<0.01
White-collar workers	11.1		10.8		15.6		19.6	
Entrepreneurs	7.0		8.6		15.2		17.5	
Workers (ref. cat.)	8.6		9.4		13.6		16.1	
Working hours								
Full time	8.1	<0.001	9.3	<0.01	13.8	<0.01	17.5	NS
Part time	12.4		10.9		16.8		20.1	
Unemployed	18.5		14.5		17.6		18.5	
Education								
Primary	8.5	NS	9.1	NS	13.9	NS	16.1	<0.001
Secondary	10.1		11.0		16.0		17.8	
College/university	10.2		9.6		14.7		21.9	
General health								
Healthy	7.8	<0.001	8.8	<0.001	13.6	<0.001	17.4	<0.001
Remaining	24.5		19.5		23.3		24.8	
Tobacco use								
Daily	9.4	NS	10.6	NS	15.1	NS	18.4	NS
Not daily	9.6		9.7		14.5		18.1	
Appearance								
Very Important	12.2	<0.01	11.3	NS	16.8	<0.05	19.3	NS
Remaining	9.0		9.6		14.2		18.1	
Function								
Very important	9.0	NS	7.1	NS	15.5	NS	19.4	NS
Remaining	9.6		10.1		14.7		18.1	
Satisfaction dental care								
Satisfied	8.9	<0.001	9.3	<0.001	14.2	<0.001	17.6	<0.001
Remaining	21.6		21.7		23.4		28.4	
Utilization dental care								
High	16.0	<0.001	13.9	<0.01	17.0	NS	27.9	0.001
Remaining	9.0		9.6		14.4		17.3	

Table 3. Logistic regression models for reported pain from TMJ, bruxism, difficulty in wide mouth opening and TMJ sounds (dependent) and social variables (independent). The *P* value denotes the statistical significance

	Pain from TMJ		Difficulty open		TMJ sounds		Reported bruxism	
Independent variables	*P*	OR	*P*	OR	*P*	OR	*P*	OR
Social attributes								
Marital status: single	NS	1.20	NS	1.09	NS	1.04	0.01	1.27
Gender: women	0.0001	1.69	0.02	1.28	0.0001	1.45	0.0007	1.33
Occupational status								
White-collar workers—leading positions	NS	1.08	NS	0.97	NS	1.26	NS	1.22
White-collar workers	0.006	1.41	NS	1.12	NS	1.19	0.035	1.22
Entrepreneurs	NS	1.05	NS	0.87	NS	1.22	NS	1.05
Workers (ref. cat.)								
Education								
College/university	NS	1.19	NS	1.08	NS	0.94	0.004	1.40
Secondary	NS	1.10	NS	1.20	NS	1.12	NS	1.09
Primary education (ref. cat)								
Health variables								
General self-perceived health: Not healthy	0.0001	2.24	0.0001	1.70	0.0001	1.53	0.0001	1.37
Tobacco use	NS	1.04	NS	1.07	NS	1.04	0.0002	1.35
Dental attitudes and behavior								
Function important	NS	1.10	NS	0.94	NS	1.03	0.04	1.22
Dissatisfied with dental care	0.0001	1.62	0.0001	1.45	0.0001	1.33	0.0001	1.45
High utilization of dental care	0.01	1.08	NS	1.01	NS	0.99	0.002	1.10

of TMD pain over a 3-year period found the rate of onset to be significantly increased for subjects who had other pain conditions at baseline (37). Clinical studies have documented that TMD patients have a high prevalence of other somatic symptoms (38–42). These findings support the notion that pain and dysfunction in the masticatory system are related to muscle and joint disorders in general. It is, however, easy to agree with the suggestion that more research using prospective design is needed to clarify this relationship (20).

The adequacy of using self-reported general health may be questioned, but several studies have indicated that it could be a valid measure, especially as there is a lack of good medical methods to index general health in epidemiologic investigations (43).

There was a higher risk among those who were dissatisfied with dental care to report TMD symptoms. It is difficult to explain this association, but one possible explanation could be that subjects who experience TMD-related problems with symptoms often located in the facial and dental regions simply believe that it is caused by previous dental treatment (and thereby dissatisfied). Neither can it be precluded that in some cases poor dentistry co-exists with, or negatively affects, an ongoing TMD problem, which could be another explanation for the reported association. High utilization of dental care was also associated with a slightly increased risk (OR 1.08) of pain from the TMJ region. A possible explanation may be that subjects with TMD symptoms have sought care for their problems. Another explanation could be that mechanical damage (tooth and filling fractures, etc.) inflicted by bruxism was responsible for the high utilization of dental care, as bruxism was shown to be strongly correlated with TMD symptoms in this material (26).

Potential risk factors in the psychosocial domain include stress, depression, and somatic distress (20). Only the last factor was included in this study as the variable general health, and corroborated its potential as risk factor for TMD symptoms as well as for bruxism.

Reported bruxism was the dependent variable demonstrating most significant associations with the independent variables. Besides the similar associations as found with TMD symptoms and discussed above, individuals using tobacco, being single and having a college education reported more bruxism than the remaining part of the sample/population. It may be tempting to interpret these associations as having psychological and lifestyle implications, because it has often been suggested that bruxism is associated with psychological factors and stress (22). A recent study, however, has demonstrated that bruxism behaviors, in contrast to previous findings, were not highly influenced by day-to-day variations in stress, anger, and physical activity (44). Methodological problems regarding bruxism, such as self-report of bruxism, and putting together as bruxism the probable two entities of parafunction, tooth-clenching during day-time and nocturnal tooth-grinding, have been discussed in a previous paper (26). The present findings suggest that reported bruxism is associated with several social and general health factors. The mechanisms for such associations are not yet well known. The data in this paper are now 12 years old and it is unclear how they represent the 50-year-old subjects of today. In this regard, ongoing follow-up studies of the examined population may help improve our understand-

ing of the relationship between social and general health factors and TMD and bruxism.

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Received for publication 9 March 2004
Accepted 13 July 2004