

ORIGINAL ARTICLE

Differences in four reported symptoms related to temporomandibular disorders in a cohort of 50-year-old subjects followed up after 10 years

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Abstract

Objective. To assess possible changes in the prevalence of four temporomandibular disorder (TMD) symptoms reported by subjects at age 50 and again 10 years later. **Material and methods.** Identical questionnaires were sent out in 1992 and in 2002 to all subjects born in 1942 and living in two Swedish counties. Of those who answered the four questions on TMD symptoms in 1992, 74% responded in 2002 ($n = 4639$). The response alternatives were dichotomized into two groups: 1) No problems and 2) some, rather severe and severe problems. **Results.** The mean prevalence of TMD-related symptoms reflected small and mainly non-significant changes, whereas the prevalence of reported bruxism was significantly greater at age 60 than at age 50. Among those with no TMD symptoms at age 50, 5–7% of the men and 8–9% of the women reported symptoms at age 60. Of those reporting one or more TMD symptoms at age 50, 47–65% of the men and 40–48% of the women had no symptoms 10 years later. There was a significant and markedly increased risk of reporting TMD symptoms and bruxism ($OR > 10$) at age 60 among those who had symptoms at age 50. **Conclusions.** The mean prevalence of reported TMD symptoms was relatively consistent from age 50 to age 60. The group reporting symptoms at the first examination were highly likely still to have the symptoms 10 years later. However, approximately half of the subjects with TMD symptoms at age 50 reported no symptoms at age 60.

Key Words: *Bruxism, epidemiology, longitudinal study, orofacial pain, questionnaire*

Introduction

Studies in children and adolescents have shown that there is a marked fluctuation in the signs and symptoms of temporomandibular disorders (TMD) over time. TMD signs and symptoms are common but mainly mild in childhood, and the prevalence increases up to young adulthood, after which it levels out or even decreases [1,2]. In elderly people, the prevalence of reported symptoms related to TMD decreases, whereas that of clinical signs increases with increasing age [3,4]. In young adults and middle-aged subjects, there seems to be a more variable longitudinal development of TMD signs and symptoms [5–8]. Most studies have reported a higher prevalence in women than in men [9–11], and a marked difference has been demonstrated between

the genders for the long-term courses of TMD signs and symptoms [12].

There are many conflicting theories concerning the etiology of TMD. The long-standing controversy regarding the role of occlusal features has been de-emphasized recently, and biologic, behavioral, and psychosocial factors have come under increasing scrutiny during the past decade [10,13–16]. The possible relationship between bruxism and TMD signs and symptoms has been studied and discussed extensively, and remains a controversial issue [17,18]. In the past few years, there have been several studies describing overlapping conditions, or comorbidity, between TMD and other chronic symptoms, e.g. headache, neck pain, fibromyalgia, and other general health and psychosomatic complaints [15,19–23].

The varying pattern of development of TMD signs and symptoms in different age groups exposed in the literature was the incentive for this study. The possibility to use epidemiological data for further evaluation of remaining questions on TMD etiology was also considered of interest. The aim was to study differences in four reported symptoms related to TMD in subjects born in 1942 examined by questionnaires in 1992 and 2002. Two hypotheses were: 1) There would be a decreased prevalence of reported symptoms related to TMD from 1992 to 2002; 2) In the group of subjects reporting symptoms in 1992, the risk of these symptoms still being present in 2002 would be high.

Material and methods

Population and response rate

Identical questionnaires were sent to all subjects born in 1942 and living in the Swedish counties of Örebro and Östergötland in 1992 ($n=8888$) and in 2002 ($n=8260$). The response rate was 71% for the 50-year-olds in 1992 and 75% for the 60-year-olds in 2002. Of the original sample of 8888 50-year-old subjects, 4639 answered the question on TMD pain in both 1992 and 2002 (74% of those who answered in 1992) and were included in the follow-up sample.

Analysis of non-response

Of the 8888 individuals comprising the total population of 50-year-olds in 1992, 861 died or moved out from the counties during the follow-up period. With these persons excluded from the original sample, 58% of the available subjects answered in both 1992 and 2002. The number of individuals who moved to the counties was 473. There were 1632 individuals of the 8888 who did not respond in either 1992 or in 2002, the gender distribution being 56% men and 44% women. A separate analysis of individuals who responded once, either in 1992 or in 2002, was performed using the following variables: gender, place of birth, education, self-assessed general health, number of teeth, pain from the TMJ region, TMJ sounds, difficulty in opening, reported bruxism. The non-respondents in 1992 but who responded in 2002 were compared to the remaining as regards the above-mentioned variables. The same procedure was carried out in the 1992 data set for those who did not respond in 2002 (Table I).

Questionnaire

The questionnaire comprised 53 questions with altogether 123 items. The questions were divided into socio-economic conditions (e.g. age, gender, occupation), general health (e.g. physician visits, tobacco habits, drug consumption), and oral conditions (e.g. satisfaction with teeth, oral problems, oral

hygiene habits, number of teeth). In this study, the answers to four questions on TMD-related symptoms and bruxism were analyzed. These were as follows: Do you have problems with: (a) pain from the TMJ region, (b) clicking or crepitation from the TMJs, (c) opening wide, and (d) grinding/clenching the teeth. The four response categories were: 1) no problems, 2) some problems, 3) rather great problems, and 4) severe problems.

In a previous study using the same methods and questionnaire, a clinical examination was performed in a randomly selected subgroup of the total sample (457 M and 484 F) in order 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 [24]. The design of the questionnaire has been described previously [25]. The original study in 1992 was approved by the Ethics Committee in the Örebro and Östergötland region, Sweden, but, depending on new regulations, approval of the study in 2002 by an ethics committee was not necessary.

Statistical methods

All statistical analyses were performed using the Statistical Package for Social Sciences (SPSS, Release 14; SPSS, Chicago, Ill., USA). The Wilcoxon signed ranks test, chi-square test, and odds ratios (OR) were used to analyze differences between groups and a logistic regression was performed. In the regression model, the following criteria were used: 1) theoretical relevance; 2) t -test significance; 3) R-square increment; and 4) changes in other variables [26].

The dichotomizations for the independent variables (taken from the 1992 responses) included in the logistic regression model are given in Table II. The dependent variable was: 1) individuals free of TMJ pain in both 1992 and 2002 ($n=3959$) and 2) individuals having pain from TMJ in both 1992 and 2002 ($n=186$) (some, rather great or severe problems). The same analysis was carried out for problems in mouth opening: 1) individuals with no opening problems in both 1992 and 2002 ($n=3913$) and 2) individuals having opening problems in both 1992 and 2002 ($n=254$) (some, rather great or severe problems).

Results

Analysis of non-response

There were several relatively small but statistically significant differences between the once-responders and the responders. However, the results varied between the 1992 and 2002 data sets (Table I).

Table I. Percentage distribution of the individuals who did not respond (Non-resp) in 1992, but did so in 2002, extracted from the 2002 data file and compared to the remaining (Remain) in selected variables. The same analyses performed for those who did not respond in 2002 (n varying between 1200 and 1300 for the different variables).

	2002 data file			1992 data file		
	Non-resp 1992	Remain	p	Non-resp 2002	Remain	p
Gender						
Men	49.4	48.7	NS	44.6	51.2	***
Women	50.6	51.3		55.4	48.8	
Place of birth						
Sweden	91.6	95.1	***	85.4	95.6	***
Nordic	4.4	2.7		4.4	2.7	
Other	4.0	1.7		10.2	1.7	
Education						
Elementary school	44.8	42.5	NS	41.8	39.6	**
High school and college	27.3	30.9		26.5	31.3	
University	27.4	26.6		31.7	29.1	
Do you consider yourself healthy?						
1. Yes, absolutely, very healthy	68.5	77.9	***	82.0	90.8	***
2. No, not particularly, absolutely not	31.5	22.1		18.0	9.2	
Number of teeth						
1. All teeth left, single missing	64.1	74.9	***	70.0	80.2	***
2. Rather many missing, almost none left, edentulous	35.9	25.1		30.0	19.8	
TMD pain						
No problem	87.4	89.7	*	88.3	91.0	**
Problem	12.6	10.3		11.7	9.0	
Sound from TMJ						
No problem	82.8	84.3	NS	85.3	85.4	NS
Problem	17.2	15.7		14.7	14.6	
Difficulty in opening						
No problem	86.9	87.9	NS	89.9	90.1	NS
Problem	13.1	12.1		10.1	9.9	
Reported bruxism						
No problem	78.2	78.5	NS	79.6	82.4	*
Problem	21.8	21.5		20.4	17.6	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

According to both data sets, the once-responders were more often born outside Sweden, more often reported impaired general health, more missing teeth and more TMJ pain than those who responded on both occasions.

Follow-up data

In the follow-up sample, the mean prevalence of TMD-related symptoms showed only minor changes over the 10-year period (Table III). The only significant increase was found for difficulty in jaw opening in women. The prevalence of bruxism increased significantly between 50 and 60 years of age in both genders (Table III). However, individual fluctuation occurred. Among those without TMJ pain at age 50, 5% of the men and 8% of the women reported such pain at age 60. However, for men and women put together, the increase between 50 and 60 was significant for both TMJ pain ($p = 0.013$) and

difficulty in jaw opening ($p = 0.001$) but not for joint sounds ($p = 0.185$).

The 10-year incidence of TMD symptoms (TMJ pain and sounds and difficulties in wide opening), i.e. the proportion of those who had no symptoms at age 50 but reported symptoms at age 60, for TMJ pain was higher for women (7.9%) than for men (5.1%) ($p < 0.001$). Incidence concerning difficulty opening the mouth was 8.4% for women and 4.9% for men ($p < 0.001$). There was no significant difference concerning TMJ sounds (women 7.2% men 9.2%). Of those not aware of bruxism at age 50, 14.3% of the women and 11.4% of the men reported bruxism at age 60, the difference between genders not being significant.

Among those reporting TMJ pain at age 50, 65% of the men and 48% of the women had no pain 10 years later. For the other TMD symptoms and for bruxism the ratio of subjects who went from symptomatic to non-symptomatic was lower (Table IV).

Table II. Dichotomization of the independent variables (1992 data) and number of responding individuals (*n*) used in the logistic regression.

Gender (<i>n</i> = 4639)	1. Men 2. Women
Place of birth (<i>n</i> = 4635)	1. Sweden 2. Nordic/other country
Residence (<i>n</i> = 4595)	1. Densely populated areas 2. Village/countryside
Working hours (<i>n</i> = 4613)	1. Work ≥ 35 hours/week 2. Work 1–4 or 15–34 hours/week or unemployed
Shift work (<i>n</i> = 4596)	1. Yes 2. No
Education (<i>n</i> = 4200)	1. Elementary school 2. High school/college/university
Marital status (<i>n</i> = 4635)	1. Married, cohabiting 2. Unmarried
Socio-economic index (SEI) (<i>n</i> = 4427)	1. Blue-collar workers 2. White-collar workers/entrepreneurs
Health compared to others of same age (<i>n</i> = 4365)	1. Better or same 2. Worse
Use of medicine in last 2 weeks (<i>n</i> = 4624)	1. Yes 2. No
Sick listing last 3 months (<i>n</i> = 4598)	1. Yes, more than a week/some days/once 2. No
Smokeless tobacco (<i>n</i> = 4586)	1. Daily snuffer 2. Remaining
Smoking (<i>n</i> = 4639)	1. Daily smoking 2. Remaining
Do you have dry mouth during daytime or at night? (<i>n</i> = 4632)	1. Yes, often/yes, sometimes 2. No, rarely/no, never
When did you last experience toothache? (<i>n</i> = 4620)	1. During the last three months/during the last year 2. >1 year ago/have never had toothache/cannot remember
Previous orthodontic treatment (<i>n</i> = 4621)	1. Yes 2. No/do not remember
Number of teeth (<i>n</i> = 4550)	1. All teeth left/single missing 2. Rather many missing/almost none left/edentulous
Problems with overbite or overjet (<i>n</i> = 4587)	1. No 2. Some problems/rather many/great problems
Problems with (a) wounds or blisters in the mouth (<i>n</i> = 4622); (b) burning mouth (<i>n</i> = 4604); (c) change of taste (<i>n</i> = 4596); (d) sensitive teeth (<i>n</i> = 4592); (e) bruxism (<i>n</i> = 4608)	1. No 2. Some problems/rather many/great problems
Satisfied with teeth (<i>n</i> = 4617)	1. Very satisfied/overall satisfied 2. Not particularly satisfied/absolutely not satisfied

For all four symptoms and for bruxism, the ratio of recovery was lower for women than for men.

There was a significant and markedly increased risk (odds ratio, OR > 10) of reporting TMD problems at age 60 in the case of those who had problems at age 50 (Table V). The highest odds ratio was for difficulty opening the mouth (men OR = 22.0, women OR = 16.2), indicating that those who had reported that particular symptom at age 50 had a very high risk of having the same symptom 10 years later.

Logistic regression

Several general and oral health problems were significantly associated with TMD pain (Table V).

The independent variables bruxism, burning mouth, taste changes, female gender, white-collar workers/entrepreneurs, medicine intake, health worse compared to those of the same age, and sensitive teeth, exhibited, in order of size, the highest odds ratios for TMJ pain (> 2). Problems with opening the mouth wide were also associated with some general and oral health problems but with lower OR compared to TMJ pain (Table V). Only the variable bruxism showed an odds ratio > 2.

Discussion

The subjects in this follow-up study tended on average to report more TMD symptoms at age 60

Table III. Percentage distribution of reported symptoms related to TMD and of bruxism in men and women examined at age 50 and 60 years ($n=4639$).

Reported symptom	Category	Men					Women				
		50 years old		60 years old		<i>p</i>	50 years old		60 years old		<i>p</i>
		<i>n</i>	%	<i>n</i>	%		<i>n</i>	%	<i>n</i>	%	
TMJ pain ¹	No problems	2137	93.9	2119	93.1	NS	2096	88.7	2060	87.2	NS ⁴
	Some	130	5.7	143	6.3		214	9.1	248	10.5	
	Rather great	6	0.3	6	0.3		40	1.7	37	1.6	
	Severe	3	0.1	8	0.4		13	0.6	18	0.8	
	Sum	2276		2276			2363		2363		
Difficulty in ¹ jaw opening	No problems	2083	91.5	2070	90.9	NS	2111	89.3	2034	86.1	***
	Some	162	7.1	173	7.6		195	8.3	249	10.5	
	Rather great	21	0.9	16	0.7		36	1.5	50	2.1	
	Severe	10	0.4	17	0.7		21	0.9	30	1.3	
	Sum	2276		2276			2363	237	2363	228	
TM joint sounds ²	No problems	1994	88.0	1977	87.4	NS	1976	84.1	1939	82.8	NS
	Some	237	10.5	262	11.6		316	13.4	343	14.7	
	Rather great	25	1.1	18	0.8		41	1.7	45	1.9	
	Severe	9	0.4	6	0.3		17	0.7	14	0.6	
	Sum	2265		2263			2350		2341		
Bruxism ³	No problems	1932	85.4	1840	81.5	***	1888	80.5	1790	76.5	***
	Some	284	12.5	352	15.6		375	16.0	436	18.6	
	Rather great	36	1.6	51	2.3		58	2.5	79	3.4	
	Severe	11	0.5	16	0.7		24	1.0	36	1.5	
	Sum	2263		2259			2345		2341		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Missing data: ¹None missing; ²Men: 11 individuals at 50, 13 individuals at 60; Women: 13 individuals at 50, 22 individuals at 60; ³Men: 13 individuals at 50, 17 individuals at 60; Women: 18 individuals at 50, 22 individuals at 60; ⁴ $p = 0.06$.

than they did 10 years previously, although there was a significant increase only for difficulty in jaw opening in women when genders were analyzed separately. However, for men and women taken together there was a small but significant increase between 50 and 60 for both TMJ pain and difficulty in jaw opening but not for joint sounds. This was in contrast to the first hypothesis, which was based on the earlier finding that elderly people (≥ 70 years of age) tended to report fewer TMD symptoms with increasing age [3,4]. In a large population cohort study of 50- and 60-year-old subjects from the same region in Sweden as this study, the 50-year-old group reported more TMD symptoms than the

older group [15]. This was interpreted as support for the mentioned longitudinal studies. It is obvious that the present 10-year follow-up results of 50-year-old subjects deviated from the cross-sectional data of 50- and 60-year-old subjects born in 1952 and 1942, respectively. The two cohorts born 10 years apart have experienced different psychosocial and economic conditions and societal changes, which was suggested as an explanation for the differences [27]. To further complicate the picture, a recent study could not demonstrate any significant differences regarding single TMD-related symptoms between two cohorts of 70-year-old subjects examined 8 years apart [23].

Table IV. Distribution (among 2276 M and 2363 F) of subjects with reported TMD problems and bruxism at age 50, and percentage of those with no symptoms and those with remaining symptoms 10 years later (some, rather great or severe problem). Odds ratio (OR) denotes the risk of having remaining symptoms after 10 years. CI = confidence interval.

		Symptom at age 50	Symptom at age 60	OR (95% CI)
TMD pain	Men	139	48 (35%)	9.8 (6.6–14.7)
	Women	267	138 (52%)	12.5 (9.4–16.7)
Difficulty opening mouth	Men	193	103 (53%)	22.0 (15.6–31.1)
	Women	252	151 (60%)	16.2 (16.2–21.8)
TMJ sounds	Men	268	143 (53%)	14.8 (11.1–19.9)
	Women	369	219 (59%)	14.4 (11.1–18.7)
Bruxism	Men	328	197 (60%)	11.7 (9.0–15.2)
	Women	454	282 (62%)	9.8 (7.8–12.4)

Table V. Logistic regression model. Dependent variables, pain from TMJ in both 1992 and 2002 ($n=186$, remaining $n=3959$) and problem opening mouth wide in both 1992 and 2002 ($n=254$, remaining $n=3913$). OR = odds ratio, CI = confidence interval.

Independent variable (see Table II)	Pain from TMJ	Problem opening
	OR (95% CI)	OR (95% CI)
Female gender	2.5 (1.5–4.2)	1.1 (0.7–1.6)
Born outside Sweden	1.9 (0.9–4.1)	1.1 (0.5–2.3)
Living in populated area	1.0 (0.6–1.5)	1.1 (0.8–1.5)
Shift work	1.4 (0.7–2.9)	0.7 (0.4–1.4)
Part-time working or unemployed	1.3 (0.8–2.2)	1.6 (1.1–2.4)
High school, college/university education	1.1 (0.7–1.9)	1.1 (0.7–1.6)
Unmarried	1.3 (0.8–2.2)	1.2 (0.7–1.9)
White-collar workers or entrepreneurs	2.4 (1.3–4.2)	1.6 (1.0–2.4)
Health worse compared to same age	2.1 (1.2–3.9)	1.5 (0.9–2.6)
Medicine intake last 2 weeks	2.2 (1.4–3.4)	1.1 (0.7–1.5)
Sick listing last 3 months	1.5 (0.9–2.4)	1.2 (0.8–1.8)
Smokeless tobacco	1.7 (0.6–5.0)	0.8 (0.3–1.8)
Smoker	0.7 (0.4–1.1)	0.8 (0.6–1.2)
Dry mouth	1.7 (1.1–2.7)	1.6 (1.2–2.3)
Toothache	1.8 (1.1–3.0)	1.2 (0.8–1.9)
Previous orthodontic treatment	1.6 (0.9–2.8)	1.1 (0.7–1.8)
Reduced number of teeth	1.5 (0.9–2.5)	1.4 (0.9–2.2)
Overbite or overjet	1.7 (0.9–3.1)	1.2 (0.7–2.1)
Burning mouth	2.8 (1.4–5.6)	1.8 (1.0–3.3)
Wounds/blisters	1.6 (1.0–2.7)	1.8 (1.2–2.6)
Taste changes	2.7 (1.5–4.8)	1.4 (0.8–2.5)
Sensitive teeth	2.0 (1.3–3.1)	1.3 (0.9–1.9)
Not satisfied with teeth	1.4 (0.8–2.3)	1.1 (0.7–1.6)
Bruxism	4.0 (2.6–6.2)	2.9 (2.0–4.0)

In children and adolescents, it is well established that the prevalence of TMD symptoms increases with age [2,9,10]. In young adults and middle-aged subjects, the available results are not conclusive. The present results of a large sample suggest that 50-year-old people are at only a small risk of developing subjective TMD symptoms, at least as based on two-point estimates 10 years apart. By contrast, about half of those reporting one or more TMD symptoms at age 50 did not report any such symptoms 10 years later. Some caution is obviously necessary when comparing results from cross-sectional and follow-up studies.

Many longitudinal studies emphasize that TMD symptoms tend to fluctuate over time [2,9,27–29]. It is therefore likely that fluctuation of symptoms also occurred in this sample between the two examinations. Dental treatment during the follow-up period may also influence the prevalence of symptoms. This has not been analyzed in this study. Such factors may partly explain the relatively low 10-year incidence (<10%). In studies with shorter intervals between examinations, an annual incidence of TMD of 2–3% has been found [2,30]. However, many of those who reported symptoms at age 50 did so also at age 60, indicating an increased risk of maintained symptoms in those with earlier experience of such symptoms (Table IV). In this context, it is interesting that subjects with a history of TMD reacted more strongly to artificial interferences than subjects with no TMD experience [6,31].

A more unfavorable long-term development of TMD symptoms in women than in men has been demonstrated [12]. More recent studies have found that a substantial proportion of both men and women with TMD symptoms showed no remission of their symptoms over time [6–8]. This was evident in the present study, too. Women had more severe symptoms, more often reported new symptoms, and experienced less remission of symptoms than men did, which is in accordance with several previous investigations [2,10–12].

The prevalence of self-reported bruxism showed greater changes than that of the TMD symptoms between the two examinations. Almost two-thirds of those who were aware of bruxism at age 50 were also aware at age 60. The odds ratio of 10.6 suggests a substantially greater risk of reporting problems with bruxism after 10 years among those who reported bruxism at age 50 compared to those who did not. It is well established that people are often unaware of their parafunctional habits and therefore self-reports of bruxism may lack validity. The increased prevalence of self-reported bruxism may also be a result of increased discussions on these and other oral parafunctions in the media and among dental teams in the past decade.

Increased stress in society and working life has often been suggested to be associated with increased levels of bruxism and orofacial pain, and recent studies have found some support for such associations [17,29,32,33]. The possible relationship between bruxism and TMD signs and symptoms has

been studied and discussed extensively and remains a controversial issue [17,18,32–34]. In this study, self-reported bruxism showed the highest odds ratios among the analyzed independent variables, for having remaining TMD pain and difficulty in opening during the follow-up period (Table V). This lends support to the contention that there is an association between TMD symptoms and awareness of bruxism.

The results of the present study are interesting because they are based on a very large population sample. The participation rate was 74%, which would seem acceptable for a longitudinal study over 10 years. In previous studies using the same methods, nothing in the non-response to the questionnaire indicated that there were serious deviations from randomness [24]. The study design and validity of the questionnaire methodology have also been investigated and found adequate for large study populations where minor measurement fluctuations level out [25]. The risk of sensitization or “recall bias” from the first questionnaire was considered small with a time interval of 10 years between the examinations. Furthermore, the questions focused on the present symptoms on each occasion.

In this study, those who answered on both occasions and those who answered on only one occasion were compared (Table I). There were some differences between the two groups and the results were in correspondence with an analysis of non-responders in a previous longitudinal study between 1992 and 1997 on the same material [35]. Since the once-responders reported more TMD symptoms and more often impaired general health, etc., the loss of this group seems not to weaken the results, but rather to strengthen them.

As regards the correlation between intraoral symptoms (burning mouth, taste changes, toothache, dry mouth, sensitive teeth, wounds/blisters) and the presence of TMD pain and difficulty in opening, a plausible explanation cannot be given at this stage. Further studies are necessary in this respect. However, a recent study in 70-year-old subjects demonstrated similar correlations between TMD symptoms, burning mouth, dry mouth and a number of general health symptoms [23]. It was suggested that TMD symptoms are common in persons with a multitude of health problems. This observation has been supported in several recent studies reporting comorbidity between TMD, facial pain and other chronic health complaints [19,24,27,36].

Conclusions

The mean prevalence of reported TMD symptoms was largely consistent, whereas reports of bruxism increased from age 50 to age 60. The group with

symptoms at age 50 were at high risk (odds ratio >10) of reporting the same symptoms 10 years later. The 10-year incidence of new TMD symptoms was higher in women than in men, but below 10% in both genders. On the other hand, approximately half of the subjects with TMD symptoms at age 50 reported no symptoms at age 60.

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References

- [1] Mohlin B, Derweduwen K, Pilley R, Kingdon A, Shaw WC, Kenealy P. Malocclusion and temporomandibular disorder: a comparison of adolescents with moderate to severe dysfunction with those without signs and symptoms of temporomandibular disorder and their further development to 30 years of age. *Angle Orthod* 2004;74:319–27.
- [2] Magnusson T, Egermark I, Carlsson GE. A prospective investigation over two decades on signs and symptoms of temporomandibular disorders and associated variables. A final summary. *Acta Odontol Scand* 2005;63:99–109.
- [3] Österberg T, Carlsson GE, Wedel A, Johansson U. A cross-sectional and longitudinal study of craniomandibular dysfunction in an elderly population. *J Craniomandib Disord* 1992;6:237–45.
- [4] Nordström G, Eriksson S. Longitudinal changes in craniomandibular dysfunction in an elderly population in northern Sweden. *Acta Odontol Scand* 1994;52:271–9.
- [5] Yatani H, Kaneshima T, Kuboki T, Yoshimoto A, Matsuka Y, Yamashita A. Long-term follow-up study on drop-out TMD patients with self-administered questionnaires. *J Orofac Pain* 1997;11:258–69.
- [6] 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;14:224–32.
- [7] Brown DT, Gaudet EL Jr. Temporomandibular disorder treatment outcomes: second report of a large-scale prospective clinical study. *Cranio* 2002;20:244–53.
- [8] Rammelsberg P, LeResche L, Dworkin S, Mancl L. Longitudinal outcome of temporomandibular disorders: a 5-year epidemiologic study of muscle disorders defined by research diagnostic criteria for temporomandibular disorders. *J Orofac Pain* 2003;17:9–20.
- [9] Carlsson GE. Epidemiology and treatment need for temporomandibular disorders. *J Orofac Pain* 1999;13:232–7.
- [10] LeResche L. Epidemiology of temporomandibular disorders: implications for the investigation of etiologic factors. *Crit Rev Oral Biol Med* 1997;8:291–305.
- [11] Johansson A, Unell L, Carlsson GE, Söderfeldt B, Halling A. Gender differences in symptoms related to temporomandibular disorders in a population of 50-year-old subjects. *J Orofac Pain* 2003;17:29–35.
- [12] Wänman A. Longitudinal course of symptoms of craniomandibular disorders in men and women. *Acta Odontol Scand* 1996;54:337–42.
- [13] Carlsson GE, Magnusson T. Management of temporomandibular disorders in the general dental practice. Chicago: Quintessence; 1999.
- [14] De Boever JA, Carlsson GE, Klineberg IJ. Need for occlusal therapy and prosthodontic treatment in the management of temporomandibular disorders. Part I. Occlusal interferences and occlusal adjustment. *J Oral Rehabil* 2000;27:367–79.

- [15] Johansson A, Unell L, Carlsson GE, Söderfeldt B, Halling A. Risk factors associated with symptoms of temporomandibular disorders in a population of 50- and 60-year old subjects. *J Oral Rehabil* 2006;33:473–81.
- [16] Niemi PM, Le Bell Y, Kylmä M, Jämsä T, Alanen P. Psychological factors and responses to artificial interferences in subjects with and without a history of temporomandibular disorders. *Acta Odontol Scand* 2006;64:300–5.
- [17] Kato T, Thie NMR, Huynh N, Miyawaki S, Lavigne GJ. Topical review: Sleep bruxism and the role of peripheral sensory influences. *J Orofac Pain* 2003;17:191–213.
- [18] Lobbezoo F, Lavigne GJ. Do bruxism and temporomandibular disorders have a cause-and-effect relationship? Review. *J Orofac Pain* 1997;11:15–23.
- [19] Hedenberg-Magnusson B, Ernberg M, Kopp S. Symptoms and signs of temporomandibular disorders in patients with fibromyalgia and local myalgia of the temporomandibular system. A comparative study. *Acta Odontol Scand* 1997;55:344–9.
- [20] Aaron LA, Burke MM, Buchwald D. Overlapping conditions among patients with chronic fatigue syndrome, fibromyalgia, and temporomandibular disorder. *Arch Intern Med* 2000;160:221–7.
- [21] Aggarwal VR, McBeth J, Zakrzewska JM, Lunt M, Macfarlane GJ. The epidemiology of chronic syndromes that are frequently unexplained: do they have common associated factors? *Int J Epidemiol* 2006;35:468–76.
- [22] Storm C, Wänman A. Temporomandibular disorders, headaches, and cervical pain among females in a Sami population. *Acta Odontol Scand* 2006;64:319–25.
- [23] Österberg T, Carlsson GE. Relationship between symptoms of temporomandibular disorders and dental status, general health and psychosomatic factors in two cohorts of 70-year-old subjects. *Gerodontology* 2007;24:129–35.
- [24] Unell L, Söderfeldt B, Halling A, Paulander J, Birkhed D. Oral disease, impairment, and illness: congruence between clinical and questionnaire findings. *Acta Odontol Scand* 1997;55:127–32.
- [25] Unell L. On oral disease, illness and impairment among 50-year-olds in two Swedish counties. *Swed Dent J* 1999; Suppl 135:1–45.
- [26] Studentmund AH. Using econometrics. A practical guide, 3rd edn. New York: Addison-Wesley; 1997.
- [27] Unell L, Johansson A, Carlsson GE, Halling A, Söderfeldt B. Changes in reported orofacial symptoms over a ten-year period as reflected in two cohorts of fifty-year-old subjects. *Acta Odontol Scand* 2006;64:202–8.
- [28] Dibbets JM, van der Weele LT. Sensitivity and specificity in a longitudinal temporomandibular disease study. *Cells Tissues Organs* 2005;180:31–5.
- [29] Ahlberg J, Savolainen A, Rantala M, Lindholm H, Kononen M. Reported bruxism and biopsychosocial symptoms: a longitudinal study. *Community Dent Oral Epidemiol* 2004;32:307–11.
- [30] LeReche L. Epidemiology of orofacial pain. In: Lund JP, Lavigne GL, Dubner R, Sessle BJ, editors. Orofacial pain. From basic science to clinical management. Chicago: Quintessence; 2001. p. 15–25.
- [31] Le Bell Y, Niemi PM, Jämsä T, Kylmä M, Alanen P. Subjective reactions to intervention with artificial interferences in subjects with and without a history of temporomandibular disorders. *Acta Odontol Scand* 2006;64:59–63.
- [32] Carlsson GE, Egermark I, Magnusson T. Predictors of bruxism/oral parafunctions and tooth wear in subjects over a 20-year follow-up. *J Orofac Pain* 2003;17:50–7.
- [33] van Selms MK, Lobbezoo F, Wicks DJ, Hamburger HL, Naeije M. Craniomandibular pain, oral parafunctions, and psychological stress in a longitudinal case study. *J Oral Rehabil* 2004;31:738–45.
- [34] van der Meulen MJ, Lobbezoo F, Aartman IH, Naeije M. Self-reported oral parafunctions and pain intensity in temporomandibular disorder patients. *J Orofac Pain* 2006;20:31–5.
- [35] Ståhlacke K, Söderfeldt B, Unell L, Halling A, Axtelius B. Perceived oral health: changes over 5 years in one Swedish age-cohort. *Community Dent Oral Epidemiol* 2003;31:292–9.
- [36] Sipilä K, Ylöstalo PV, Joukamaa M, Knuuttila ML. Comorbidity between facial pain, widespread pain, and depressive symptoms in young adults. *J Orofac Pain* 2006;20:32–40.