The Prevalence and Association of Signs and Symptoms of Temporomandibular Disorders with Missing Posterior Teeth in Adult Jordanian Subjects

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ABSTRACT

Objectives: To determine the prevalence of temporomandibular disorders (TMD) in adult Jordanian subjects with missing posterior teeth and the association of signs and symptoms of TMD with missing posterior teeth.

Methods: A questionnaire and clinical examination were used to assess 93 subjects who accepted to participate in this study and were selected according to specific inclusion criteria. They were asked about TMD-related symptoms (pain or tenderness in the jaw joint and/or muscles of mastication, joint sounds, limitation of jaw movement, clenching or grinding habits) and examined clinically for missing teeth, and for TMD-related signs (tenderness in masticatory muscles and in temporomandibular joint, clicking or crepitus sounds, limitation of mandibular movement, attrition in the existed remaining teeth). The mean number of missing teeth were calculated, compared and correlated with TMD signs and symptoms in relation to age and genders. Data were analyzed using SPSS (v. 17) and statistical significance was set at $P<0.05$.

Results: There were 37 (39.8%) men and 56 (60.2%) women; the mean age was 54.43±11.87 (ranged between 31 and 78) years. Eighty-five (91.4%) subjects had TMD-related signs or symptoms, 32.3% reported symptoms and 59.1% had signs, two-thirds were women. The mean number of missing teeth was 11.40±3.13, men significantly ($p<0.05$) had more missing teeth compared to women, however, significantly ($p<0.01$) more women reported TMD symptoms than men. Posterior teeth loss increased with increasing age. With age, TMD symptoms decreased and signs increased. Logistic regression analyses showed that teeth loss was significantly associated with TMD subjective symptoms; reported joint sounds ($p<0.05$), chewing difficulty ($p<0.05$) and with chewing side preference ($p=0.001$).
Logistic regression analyses showed that teeth loss was significantly associated with TMD objective signs; clicking ($p<0.01$) and crepitus ($p>0.001$) TMJ sounds, unilateral TMJ tenderness ($p=0.01$), the pterygoid muscles tenderness ($p<0.01$) and teeth wear ($p<0.05$).

Conclusion: Loss of posterior teeth is significantly associated with TMD signs and symptoms. In the group studied more women than men reported TMD symptoms and both male and female subjects were found to have TMD signs which were more common in men.

Key words: Missing posterior teeth, Prevalence, Temporomandibular disorders, TMD signs and symptoms.

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Introduction

Temporomandibular disorders (TMD) is a collective term that includes a number of clinical complaints involving the muscles of mastication, the temporomandibular joint (TMJ), or the associated orofacial structures.[1] It is considered a subclassification of musculoskeletal disorders,[2] characterized largely by facial pain,[3] and various signs and symptoms of pain and dysfunction in the TMJ and/or the masticatory musculature[4-6] and by restrictions, deviations, and limitations of range of motion.[7]

Epidemiological surveys report that 50%-70% of the population have signs of a disorder, whereas an estimated 20%-25% of the population have TMD symptoms. However, those who seek treatment represent approximately 2%-7% of the population.[6,8-13] It has been demonstrated that TMD-related signs and symptoms are more prevalent among women than among men, prevalence being highest among young and middle-aged women.[14-18] Signs and symptoms of TMD seem to decrease with increasing age, and only 4% of the very old population had severe signs of TMD.[19,20]

The etiology of TMD is still unknown,[21] however several studies reported relationships between TMD and bruxism, grinding or clenching of the teeth,[22] osteoarthrosis,[23] abnormal occlusion,[24] tooth wear[19] nonworking-side occlusal interferences,[25] limited mandibular movements,[7] auditory function,[4,5] menstrual cycle,[26] partial loss of teeth,[12] masseter muscle activity,[27] osteoarthritis,[28] Anxiety and depression[29] and reduced maximum bite force.[30]

The relationship between TMD and loss of posterior teeth is still a subject of continuous discussion and remains a controversial issue. Some studies did not find a relation between the number of absent posterior teeth and TMD.[17,31,32] However, others consider the absence of five or more posterior teeth a risk factor.[33-37]

The aims of the present study were to determine the prevalence of TMD subjective symptoms and objective signs in relation to age and gender and to evaluate the association of missing posterior teeth with these signs and symptoms in a sample of adults in the south of Jordan.

Method

The present research project was approved by The Higher Research and Ethical Committee at Royal Medical Services.

Participants:

A total of 119 (51 men and 68 women) partially edentulous patients were selected to participate in this study, they were referred from the General Dental Practice clinic, Division of Dentistry, Prince Ali Bin Al-Hussien hospital, Royal Medical Services, Al-Karak, Jordan; over a six-month period (October 2012 to April 2013) to prosthetic clinic for the provision of replacement of their partially missing teeth with removable partial denture prostheses;. Of these, 93 subjects (37 men and 56 women) corresponding to a 78.2% response rate, accepted to answer a questionnaire and undergo a clinical examination and were included according to specific inclusion criteria and required to give verbal consent.

Inclusion/exclusion criteria:

All partially edentulous patients with all maxillary and mandibular anterior teeth existed; those with two or more missing posterior teeth (premolars and molars) with the exception of third molars were included.[34] However, those who had been previously diagnosed and treated as symptomatic TMD patients, removable partial denture-wearing subjects and who were exposed to traumatic loss of teeth (i.e. car accident, gunshot, maxillofacial surgery,...etc.) were excluded from this study. None of the patients complained of symptoms or had previously sought any treatment for a TMD.[12]

Questionnaire (subjective symptoms):

All patients were required to complete a questionnaire, similar to that used in previous studies,[10,38,39] regarding their personal details such as age, gender, medical insurance number and place of residence; also to answer six questions as to whether they were aware of any

of the specific TMD-related subjective symptoms regarding joint and jaw muscle pain, limitation of mouth opening, joint sounds and tooth grinding and clenching. For positive responses, additional questions were asked about intensity (mild, moderate, or severe), frequency (rarely, sometimes, quite often, or very often) and site (unilateral or bilateral). In addition, subjects were asked about the chewing side preference, their answers were recorded as follows: chewing on the right side, left side, anterior teeth or no preference.[10]

Clinical examination (objective signs):

Initially, intra-oral dental examination was performed; all missing teeth were recorded (with the exception of third molars) and cross-marked on the sheet. All existing teeth were examined during the clinical examination; those with attrition and/or wear facets were measured and recorded. Each tooth was scored with 4-point scale according to the degree of attrition (0: no visible wear; 1: mild (only enamel); 2: moderate (enamel plus a small area of dentin); and 3: severe wear (enamel plus a large area of dentin).[24]

Then, patients were examined for TMD-related objective signs similar to that used in previous studies.[12,37] The assessment of TMD signs included recording of maximum mouth opening, auscultation of TMJ noises and palpation of the TMJ and masticatory muscles (temporalis, masseter and medial and lateral pterygoids). The maximum mouth opening was measured using a millimeter ruler after asking the patient to open as wide as possible while remaining comfortable. The maximum opening was recorded between the incisal edge of the maxillary central incisor that is the most vertically oriented and measured vertically to the incisal edge of the opposing mandibular incisor. The amount of vertical incisor overlap (the distance between the incisal edges of the upper and lower central incisors) was added to each of these measurements to determine the actual amount of opening.[40] Clicking/crepitus of the TMJ, either audible or palpable were recorded bilaterally over the TMJ region with gentle digital palpation during a number of (vertical) opening and closing movements of the mandible by bilateral palpation. TMJ tenderness to palpation was assessed by applying a gentle force over the immovable condyle and recorded unilateral or bilaterally. Masticatory muscle tenderness was assessed using bilateral digital palpation for masseter, temporalis and medial pterygoid muscles; however, lateral pterygoid muscles were examined indirectly by resistance against forward movement of the mandible since this muscle is not readily accessible to manual palpation. Joint and muscle pain on palpation was recorded if the subjects reported pain when asked or showed a protective reflex. Except for the maximum inter-incisal distance, all the findings were recorded separately for both sides, and they were combined and categorized as either present or absent.[41]

Clinical examination of the patients was performed by one “prosthodontist” examiner (the corresponding author). The use of one examiner in this study ensures continuity of interpretation of the answers provided by the subjects. To confirm intra-examiner reliability, 10 subjects were randomly selected for a repeat the questionnaire and clinical examination after 2-week interval to reduce the risk of error.

Method error:

Reliability in response of subjects to repeated questionnaire was performed using Cronbach’s one-alpha and paired Student’s t-test was performed to unveil statistically significant differences between the two values. Reliability results for joint pain exceeded 0.78, joint muscle pain was 0.83, mouth opening difficulty was 0.88, joint sounds was 0.75, tooth grinding/clenching was 0.85 and chewing side preference was 0.90 (t-test ranged between 0.0086 and 0.045; with P value >0.05 in all values). As there were strong Cronbach’s coefficient and small mean difference between the two answers, it was assumed that the questionnaire would be reliable. Reliability of clinical examination of subjects was performed by comparing the results of TMD-related signs for repeated clinical examination in the same subject. Intra-examiner correlations ranged between Kappa 0.73 and Kappa 0.85 for clinical examination of patients. The maximal mouth opening (±1 mm) had a high reliability coefficient (r = 0.87) and a random

measurement error of 1.2 mm (without a systematic error).

Statistical analysis:

Statistical analysis was performed using SPSS Statistic Version 17 (SPSS Corporation, Chicago, IL, USA). A one-sample student's t-test was used to evaluate gender differences in mean values of missing posterior teeth and of TMD-related subjective symptoms and objective signs. Chi-square test was used to determine and correlate the prevalence of TMD signs and symptoms in relation to gender. Logistic regression model was used to determine the association of number of missing teeth with TMD subjective symptoms and objective signs. Ninety-five percent confidence intervals about the mean were constructed for differences in mean values missing posterior teeth in relation to TMD signs and symptoms and between genders. Level of significance was set at 0.05.

Results

This study comprised 93 participants with mean age of 54.43±11.87 (ranged between 31 and 78) years. There were 37 (39.8%) men and 56 (60.2%) women, with mean age of 58.22±12.65 and 52.96 ±11.09; respectively. There was no statistically significant difference in the mean age between genders (mean difference of 5.26±1.56, Student's t-test was 14.06 and p value=0.916).

Eighty-five participants (91.4%) of had TMD-related signs or symptoms, only 8 men (8.6%) were found to be free from TMD symptoms or signs. Thirty (32.3%) participants responded positively to one or more TMD-related (self-reported) symptom(s). Two-thirds of them were women. The number of symptomatic subjects decreased with age in both genders, in addition, for each age group, more women responded positively to TMD-related symptoms compared to men. For the same gender, results showed that approximately 34% of women and 30% of men reported symptoms. In respect to signs found during clinical examination, the results showed that 59.1% of subjects had one or more TMD-related objective sign(s), two-thirds of them were women. For the same gender, approximately two-thirds of women and half of men had TMD sign(s). In contrast to the reported symptoms, the number of subjects with signs increased with age. In all groups, more women than men had signs except for the 70-79 age groups (45.5% men versus 27.3% women). Table I

A total of 1060 posterior teeth (mean was 11.40±3.13) were missing. Men significantly ($p<0.05$) had more missing teeth compared to women, however, significantly ($p<0.01$) more women recorded TMD symptoms in response to the questionnaire (20.5% versus 11.8%; respectively). The mean number of missing teeth increased with increasing age, however, TMD symptoms decreased with increasing age. On the contrary to symptoms, TMD signs increased with increasing age. The missing posterior teeth (number, percentage and mean) distribution in relation to TMD-related signs and symptoms (number and percentage) according to gender and age-group, are shown in Table II.

Significantly more men reported joint sounds ($p=0.01$), chewing difficulty and preferred to chew on remaining anterior teeth ($p<0.05$) compared to women. However, significantly ($p<0.05$) more women had TMJ pain and reported no preference in chewing food. Table III

Significantly more men recorded masticatory muscle tenderness in masseter and temporalis muscles ($p<0.01$), TMJ tenderness unilaterally ($p<0.001$), crepitation joint sounds ($p<0.0001$) and tooth wear ($p<0.05$) compared to women. However, significantly ($p<0.001$) more women had pterygoid muscles tenderness and clicking joint sounds compared to men. Table IV

Logistic regression models were constructed to evaluate the association of number of missing posterior teeth with TMD subjective symptoms (Table V) and objective signs (Table VI).

Analyses for subjective symptoms showed that loss of posterior teeth was significantly associated with reported joint sounds symptom (odd ratio was 0.9 for 13-16 missing teeth; $p<0.05$), chewing difficulty ($p<0.05$) and with chewing side preference ($p=0.001$).

Table I: Distribution of TMD-related symptoms and signs in relation to gender and age groups of participants (in percentage)

	30-39 n=15		40-49 n=20		50-59 n=25		60-69 n=22		70-79 n=11		Total n=93	
	M n=5	W n=10	M n=8	W n=12	M n=9	W n=16	M n=8	W n=14	M n=7	W n=4	M n=37	W n=56
Symptoms n=30 (32.3%)												
per gender per group	40.0	50.0	37.5	33.3	33.3	31.3	25.0	28.6	14.3	25.0	29.7	33.9
between gender	13.3	33.3	15.0	20.0	12.0	20.0	9.1	18.2	9.1	9.1	11.8	20.4
total per group	46.7		35.0		32.0		27.3		18.2		32.3	
Signs n=55 (59.1%)												
per gender per group	20.0	50.0	37.5	66.7	44.4	68.8	62.5	71.4	71.4	75.0	48.6	66.1
between gender	6.7	33.3	15.0	40.0	16.0	44.0	22.7	45.5	45.5	27.3	19.4	39.8
total per group	40.0		55.0		60.0		68.2		72.7		59.1	

M: men; W: women; n: number

Table II: Age and gender distribution of TMD subjective symptoms (questionnaire) and objective signs (clinical examination) in relation to missing posterior teeth

	Missing teeth		**TMD-related†**		
	n (%)	**Mean**	**Symptoms**	**Signs**	**Overall**
Men	562 (53.0)	12.27±3.04 *	11 (11.8%) **	18 (19.4%)	30 (32.3%)
Women	498 (47.0)	10.47±3.22 *	19 (20.4%) **	37 (39.8%)	55 (59.1%)
30-39	110 (10.4)	9.17±3.34	7/15 (46.7%)	6/15 (40.0%)	13 (15.3%)
40-49	186 (17.5)	10.33±3.22	7/20 (35.0%)	11/20 (55.0%)	18 (21.2%)
50-59	317 (29.9)	11.32±3.17	8/25 (32.0%)	15/25 (60.0%)	23 (27.1%)
60-69	298 (28.1)	12.42±3.08	6/22 (27.3%)	15/22 (68.2%)	21 (24.7%)
70-79	149 (14.1)	13.54±2.85	2/11 (18.2%)	8/11 (72.7%)	10 (11.8%)
Total	1060	11.40±3.13	30 (32.3%)	55 (59.1%)	85 (91.4%)

* P<0.05; ** p<0.01 (Student's t-test)

†: TMD-related signs and/or symptoms, except for 8 (8.6%) TMD-free men

Table III: Gender differences of TMD subjective symptoms (questionnaire)

	n	**Symptoms (%)**		***chi-square test***	**P value**	**95 % CI**
		Men (n=11)	**Women (n=19)**			
Muscle pain	5	2 (18.2%)	3 (15.8%)	0.87	0.174 (NS)	0.45-1.87
TMJ pain	10	1 (9.1%)	9 (47.4%)	5.21	0.019	3.85-9.55
Opening difficulty	6	2 (18.2%)	4 (21.1%)	1.16	0.144 (NS)	0.50-2.23
Joint sounds	5	4 (36.4%)	1 (5.3%)	0.15	0.010	0.005-0.37
Chewing side						
Anterior teeth	10	7 (63.6%)	3 (15.8%)	0.25	0.025	0.004-0.26
No preference	9	1 (9.1%)	8 (42.1%)	4.63	0.024	2.13-7.45
Clenching / grinding	6	2 (18.2%)	4 (21.1%)	1.16	0.144 (NS)	0.55-2.35
Chewing difficulty	7	5 (45.5%)	2 (10.5%)	0.23	0.033	0.11-0.55

Confidential intervals (CI) refer to women as reference category. The P value denotes the significance level of (chi-square test).
n=number; NS: not significant

Table IV: Gender differences of TMD objective signs (recorded from the clinical examination)

		n	Signs (%)		*chi-square test*	P value	95 % CI
			Men n=18	Women n=37			
Muscle tenderness	Masseter	23	12 (66.7%)	11 (29.7%)	0.45	0.019	0.35-0.57
	Temporalis	19	10 (55.6%)	9 (24.3%)	0.44	0.023	0.33-0.59
	Pterygoids	32	4 (22.2%)	28 (75.7%)	3.41	0.0092	2.97-4.31
TMJ tenderness	Unilateral	15	9 (50.0%)	6 (16.2%)	0.32	0.021	0.15-0.49
	Bilateral	15	5 (27.8%)	10 (27.0%)	0.97	0.065 (NS)	0.91-1.15
Limited mouth opening ∗		3	1 (5. 6%)	2 (5.4%)	0.96	0.32 (NS)	0.89-1.18
Joint sounds	Crepitus	15	10 (55.6%)	3 (8.1%)	0.15	0.0097	0.10-0.32
	Clicking	22	3 (16.7%)	19 (51.4%)	3.08	0.014	2.75-3.25
Teeth wear †		12	6 (33.3%)	6 (16.2%)	0.49	0.041	0.39-0.63

*Mean inter-incisal distance (mouth opening) was 41.66 mm; (men versus women was 43.25 and 40.07 mm; respectively, P <0.05, Student t-test).
† Mean score of teeth wear was 1.31 mm; (men versus women was 2.34 and 1.03 mm; respectively, P <0.05, Student t-test).
Confidential intervals (CI) refer to women as reference category. The P value denotes the significance level of (chi-square test).

Table V: Association of number of missing teeth with subjective TMD symptoms (in response to questionnaire) by means of logistic regression models

	Odd ratio (95% confidence interval)						
missing teeth (n)	**Muscle pain**	**TMJ pain**	**Opening difficulty**	**Joint sounds**	**Chewing side preference †**	**Clenching or grinding**	**Chewing difficulty**
1-4	1.6	0.5	0.6	2.4	1.6	0.3	0.07
5-8	1.6	0.8	0.4	2.2	1.8	0.1	0.09
9-12	1.8	0.6	0.5	2.6	3.3	0.3	0.12
13-16	1.5	0.4	0.7	0.9	3.7	0.2	1.5
P value	0.53	0.087	0.18	0.022	0.0010	0.33	0.047
	NS	NS	NS	∗	∗∗	NS	∗

Level of significant: ∗ p<0.05; ∗∗ p<0.001.
†: anterior teeth for >9 and no preference for <8 missing teeth.
CI: (confidential intervals) ranges from 0.05 to 4.6. NS: not significant; n: number.

Table VI: Association of number of missing teeth with clinical signs of TMD by means of logistic regression models

	Odd ratio (95% confidence interval)								
missing teeth (n)	**Mouth opening <40mm**	**TMJ sounds**		**Muscle tenderness**			**TMJ tenderness**		**Teeth wear**
		Clicking	**Crepitus**	**Masseter**	**Temporalis**	**Pterygoids**	**Unilateral**	**Bilateral**	
1-4	0.6	2.8	0.1	1.1	0.6	0.8	1.8	0.02	0.5
5-8	0.4	0.5	0.8	2.3	1.3	1.7	2.2	0.06	0.5
9-12	0.5	0.4	1.1	2.9	1.8	1.8	2.4	0.09	0.6
13-16	0.1	0.2	2.9	4.2	2.7	2.2	3.2	0.1	1.5
P value	0.109	0.0013	0.00096	0.069	0.082	0.0066	0.0100	0.091	0.046
	NS	∗∗	∗∗∗	NS	NS	∗∗	∗∗	NS	∗

Level of significant: ∗ p<0.05; ∗∗ p<0.01;∗ ∗∗ p<0.001.
CI: (confidential intervals) ranges from 0.02 to 4.2. NS: not significant.

Recorded odd ratios show that subjects with < 8 teeth missing had no chewing side preference, contrary to those with 9 missing teeth or more who preferred chewing on anterior teeth (Table V). Logistic regression results stratified for men and women with subjective symptoms showed that significant (p<0.05) association of joints sound, chewing difficulty and chewing on anterior teeth with >13 missing teeth predominance for men. However, significantly (p<0.05) more women reported no chewing side preference associated with <8 missing teeth. Also, results showed odd ratio of 1.7, (p<0.05) significant women domination reporting TMJ pain associated with <4 missing teeth, although the overall (men and women) participants reported insignificant odd ratio differences at 95% confidence interval.

Analyses for objective signs show that loss of posterior teeth was significantly associated with clicking ($p<0.01$) and crepitus ($p<0.001$) TMJ sounds, unilateral tenderness of TMJ ($p=0.01$) and the pterygoid muscles tenderness ($p<0.01$) and teeth wear ($p<0.05$). Odd ratios for clicking joint sound (2.8) was associated with 4 missing teeth or less, conversely, odd ratios for crepitus joint sound (2.9) was highly associated with 13 missing teeth or more. Results showed that significant associations were recorded between the number of missing posterior teeth and pterygoid muscles tenderness (Odd ratios=0.8 was significant with less than 4 missing teeth); oppositely, unilateral TMJ tenderness and teeth wear were associated with more than 13 missing teeth (Table VI). Logistic regression results stratified for men and women with clinical signs showed that significant ($p<0.05$) association of clicking TMJ sound with <4 missing teeth, and pterygoid muscles tenderness with >13 missing teeth, with women predominance. However, more men were found to have significantly ($p<0.05$) crepitus sounds and unilateral tenderness of TMJ, and tooth wear in association with >13 missing teeth.

Discussion

In this study, more than 60% of the participants were women, although there was no statistically significant difference in the mean age between genders, women were slightly younger than men. Statistics indicate that approximately one-third of subjects responded positively to questions regarding TMD-related symptoms. However, more than 59.1% of subjects had one or more TMD-related objective sign(s) recorded during the clinical examination; two-thirds of them were women. The same tendency was seen in the results of other studies.[16,42] Some studies[6,18] reported that women have a greater percentage of problems related to TMD than do men. Several attempts have been made to provide an explanation for this difference, authors attributed it to hormonal differences,[43] menstrual cycle[26] or to reduced pain threshold in women.[44]

The number of symptomatic subjects decreased with age in both genders with women predilection, inversely, the number of subjects with signs increased with age except for elderly above the age of 70 years, where more men demonstrated TMD signs compared to women. The finding that women are more symptomatic and that TMD symptoms decreased with age is well-documented in the dental literature.[9,16,18,45,46] On the contrary, TMD signs become more prevalent with age. Some investigators reported that TMD signs encountered in degenerative disease of the articular surfaces, often associated with aging, such as osteoarthrosis,[23] which is present more frequently amongst elderly patients.[28] But some studies have demonstrated that these associations decrease when the data are controlled for age.[15] Moreover, osteoarthritic changes may occur in apparently asymptomatic subjects.[20] This may explain that elderly become less symptomatic although they have already TMD signs.

The present study showed that men significantly had more missing teeth than women. Although TMD symptoms decreased with age, the signs increased and it seemed that an increase of number of posterior teeth loss is associated with TMD signs rather than symptoms.[37] This significant association between TMD signs and tooth loss is in agreement with various clinical and epidemiological studies.[12,34] However, other studies did not report similar findings.[36,47] Dulcic *et al*.,[48] suggested that the incidence and intensity of TMD are higher in subjects with greater tooth loss in the supporting zones, regardless of their sex. Tallents *et al*.,[34] reported that missing mandibular posterior teeth may accelerate the development of degenerative joint disease. In contrast, Mundt *et al*.,[35] suggested that the loss of occlusal support was significantly associated with muscle and TMJ tenderness in men only.

This study showed that there were significant gender differences in the self-reported TMD-related symptoms. Men significantly reported joint sounds and chewing difficulty, contrary to TMJ pain symptoms which was the main complaint reported by women. In addition, men preferred to chew on remaining anterior teeth

while women reported no chewing side preference. These findings that reflected the chewing difficulty reported by men rather than women were in agreement with that reported by Gavish *et al*.[49] On the other hand, Amorim *et al*.[50] found that a larger incidence of unilateral chewers was found on the left side. The increased number of missing posterior teeth among men reduced the number of posterior occlusal units which may be the reason why men chew on their anterior remaining teeth.[36] On the contrary to these significant findings, there were no gender differences in muscle pain, opening difficulty and clenching or grinding habits. Similar results were reported in previous studies.[35,51,52] The association of reduced number of teeth with altered jaw function and TMJ pain were significant risk factors for impaired chewing ability.[16,34] However, the absence of such a relationship with complaint of muscle/TMJ pain in women may indicate that other factors have more influence which could be explained by the lower biting forces exerted by women.[47]

The analyses of results of the clinical examinations showed that significantly more men had masticatory muscle tenderness in masseter and temporalis muscles, unilateral TMJ tenderness, crepitation joint sounds and tooth wear compared to women who significantly had pterygoids muscles tenderness and clicking joint sounds. Patients with few remaining natural teeth may have a higher incidence of TMD signs[12] and the reduced number of posterior teeth may cause impairment of masticatory performance and initial changes in neuromuscular pattern of jaw muscle activity.[53]

Joint sounds (clicking or crepitus) are very common among patients with TMD, and in non-patient populations.[20] Different causes of TMJ sounds have been suggested, disc displacement is probably the most common cause.[28,34,42,54,55] Of all the patients in this study with TMD signs, none was actively seeking treatment. Previous studies have shown that clicking is the most prevalent among women,[3] however, crepitus is a sign encountered in degenerative disease of the articular surfaces, often associated with aging, such as osteoarthrosis.[23,31]

Elderly patients tend to clench their teeth together during normal function which could explain the frequency of muscle tenderness in old men with missing posterior teeth and why masseter and temporalis muscles were more frequently involved than lateral pterygoid muscle, inversely, the pterygoid muscles tenderness was significantly more prevalent among women. These findings were in agreement with previous studies.[24,38,51,56-59]

The maximum mandibular opening is one of the measures used for assessment of mandibular function[19,21] and a reduced range of vertical movement may be interpreted as a TMD-related sign.[7] In this study, the clinical examination revealed that the mandibular opening was optimum and not restricted, moreover, men significantly reported more values of maximum opening than women. These findings were in accordance with a previous study, which demonstrated that an average of 40 mm seems to represent a reasonable point of incisor separation on maximal opening.[40]

The incidence and intensity of TMD are higher in subjects with greater tooth loss in the supporting zones.[2,12,34-37,53] The results of the Logistic regression models demonstrated a significant association between the number of missing posterior teeth and symptoms of reported joint sounds and chewing difficulty. Recorded odd ratios showed that subjects with less than 8 missing teeth had no chewing side preference, contrary to those with 9 missing teeth or more who preferred chewing on anterior teeth. In addition to the significant association with recorded signs of clicking and crepitus sounds, unilateral TMJ and pterygoid muscles tenderness.

The logistic regression analysis showed that tooth wear index increased as the number of missing teeth increased which also appeared to be a man risk factor. In addition, it is well-recognised that tooth wear increases with tooth loss as fewer occlusal surfaces are available for masticatory function. Tooth loss. Tooth wear and TMD may be inter-related and the increased loss of teeth has not been confirmed to be a factor associated with greater prevalence of TMD. Although the analyses of answers of the interviewed participants who reported clenching/grinding symptoms demonstrated no

association with posterior teeth loss, recently, it has been reported that patients with partial tooth loss showed significantly higher prevalence of TMJ sounds and restricted mouth opening.[12,60]

This study demonstrated a positive association between clicking joint sound and pterygoids muscles tenderness with a reduced number of missing teeth, conversely, crepitus joint sound, unilateral TMJ tenderness and teeth wear were associated with more than 13 missing teeth. Pain from the TMJ or the periauricular region, probably includes muscle pain. This could perhaps be due to the difficulty for patients to differentiate between joint and muscle pain which is also not always easy to differentiate at a clinical examination either. However, pain in the TMJ region is certainly a symptom related to TMD, and it is evidently more common in women than in men.[16,61]

Contrary to previous studies[17,39] which reported a questionable association of loss of teeth with TMD, when the evaluation is controlled for age effects due to the great adaptive capacity of the chewing system and the majority of people who have lost teeth may have acceptable chewing function and do not increase the signs or symptoms of TMD.[12] This study found an association between the number of teeth lost and TMD especially for chewing difficulty which was significant for elderly men with more teeth loss.

Based on these results, it can be concluded that the prevalence of TMD was relatively high (91.4%), taking into account that the average age of the sample was approximately 54 years, which shows that although TMD is most prevalent among young age groups 20-40 years mostly women,[16,42] the disease appears to continue in the elderly population. Similar findings were also reported in previous studies.[15,19]

The signs and symptoms of TMD tended to occur in elderly patients with missing posterior teeth.[24,34,35] In addition, occlusal relationships constitute the etiologic factors that trigger chewing muscles pain and TMJ dysfunction.[48,53]

This study covered a broad age range and used numerous covariates, such as age, gender, TMD subjective symptoms and objective signs which were included in the statistical analyses. In addition it considered not only associations, but also variables that interact between them, adjusting for other variables inherent to the patient like gender and age variables and clinical variables (number of lost teeth, clenching/grinding habits, teeth wear and side of preference for chewing). Additionally, the variables associated with symptoms of TMD were principally dependant on the response of the participants to questions, whereas for the signs, the variables were explored clinically, these observations may suggest a distinct nature in the subgroup of TMD.

Restoration of missing natural teeth has been suggested to decrease or eliminate signs and symptoms of TMD.[2,50,62,63] However, no sufficient evidence of an association between TMD and loss of molar teeth,[17,32,47] and restoration of missing teeth does not seem to decrease the prevalence of TMD.[20] Malocclusion has been one of the most frequently cited causes of both condylar displacement and masticatory muscle disorders,[19,21,52,53,56,58] although this study did not investigate the association of malocclusion with TMD signs and symptoms, further research is still needed to study the effect of these variables on TMD.

One of the limitations of this study was that it still could not be confirmed that posterior tooth loss explained the increased TMD signs because the study devoid of control group, therefore further research is still needed to compare TMD signs and symptoms between subjects with missing posterior teeth and those with intact dental arches.

Conclusion

Symptoms and signs of TMD were associated with loss of posterior teeth among Jordanian subjects included in the study, women in particular. The number of subjects who reported TMD symptoms seemed to decrease and those who had TMD signs increased with increasing age.

The number of missing posterior teeth increased with age, and was significantly associated with TMD signs and symptoms. Although more women reported symptoms, posterior teeth loss was associated with TMD signs especially among men.

Each gender significantly reported different TMD signs and symptoms from the other. Men reported joint sounds, chewing difficulty and preferred to chew on remaining anterior teeth while women had TMJ pain and reported no preference in chewing food. Also, men recorded masticatory muscle tenderness in masseter and temporalis muscles, unilateral TMJ tenderness, crepitation joint sounds and tooth wear while women recorded pterygoid muscles tenderness and clicking joint sounds.

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