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ORIGINAL ARTICLE

Psychosocial aspects of temporomandibular disorders and oral health-related quality-of-life

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Abstract

Objective. The aim of the study was to evaluate the association between psychosocial aspects of temporomandibular disorders (TMD) and oral health-related quality-of-life (OHRQoL) and, secondly, to investigate the gender differences in these associations using patient and non-patient groups. ***Materials and methods.*** The sample of the study consisted of 79 patients with TMD and 70 non-patients. The data was collected by Finnish versions of the RDC/TMD Axis II profile and Oral Health Impact Profile (OHIP-14) questionnaires. The associations between Axis II profile sub-scales and OHIP prevalence were evaluated using chi-square tests, as stratified by group status (TMD patients and non-patient controls) and by gender. The association between OHIP prevalence and Axis II profile sub-scales were evaluated using logistic regression analysis, adjusted by age, gender and group. ***Results.*** OHIP prevalence (those reporting at least one problem) was 90.9% in the patient group and 33.3% in the non-patient group ($p < 0.001$, chi-squared test). OHIP prevalence was higher among those scoring higher on all RDC/TMD Axis II profile sub-scales, i.e. graded chronic pain status, depression and non-specific physical symptoms with pain items included and with pain items excluded. The associations were significant in the non-patient group. Women showed statistically significant associations of OHIP prevalence with all Axis II sub-scales. Among men, OHIP prevalence associated with GCPS and somatization. The logistic regression analysis showed that OHIP prevalence associated significantly with somatization and depression. ***Conclusions.*** TMD associate with OHRQoL through multiple ways, linked with depression and somatization. These findings emphasize the importance of early and effective treatment of TMD.

Key Words: *temporomandibular disorders, oral health-related quality-of-life, Oral Health Impact Profile, psychosocial factors*

Introduction

Temporomandibular disorders (TMD) are defined as 'a collective term embracing a number of clinical problems that involve the masticatory muscles, the temporomandibular joint (TMJ) and associated structures, or both' [1]. The most common signs and symptoms of TMD are pain, limited range of jaw movement and TMJ noises [1].

The prevalence of TMD symptoms and signs are common in the population. In addition, among women, TMD are twice as common in the general population than among men, and in a TMD patient population the proportion of women is as much as 4-times higher than the proportion of men [2,3]. The research diagnostic criteria for TMD (RDC/TMD) provide a dual diagnosis that recognizes physical symptoms (Axis I) and psychosocial factors (Axis II) [4]. The Axis I includes sub-classifications of clinical diagnoses such as muscle disorders (i.e. myofascial pain with or without limited jaw opening) and TMJ disorders (i.e. disc dislocation with or without reduction, arthralgia, osteoarthritis and ostearthrosis). The Axis II includes sub-scales containing graded chronic pain scale, depression and somatization.

In most cases TMD typically run a chronic or recurrent course [1]. In addition to a heterogeneous group of physical conditions, TMD patients suffer from various types of psychosocial distress. Today, the general consensus is that psychological and psychosocial factors are very important in the understanding of TMD, but there is less evidence that these factors are etiologic [5]. It can be suggested that, especially when they turn chronic, TMD are

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likely to impair individuals' quality-of-life, specifically oral health-related quality-of-life (OHRQoL) which is a multidimensional concept that includes subjective evaluation of perceived physical, psychological and social aspects of oral health, even though no single measure has been developed that captures the concept completely [6].

Studies have shown a substantial negative impact on OHRQoL in patients with TMD [7-13]. Two recent studies [9,10] from patient samples have used the RDC/TMD criteria in the diagnostic classification of TMD, showing that all Axis I diagnoses have an impairing impact on OHRQoL. John et al. [9] found that there were larger differences in mean OHIP (Oral Health Impact Profile, one of the measures of OHRQoL) scores on Axis II measures compared to Axis I, the strongest association being with Graded Chronic Pain Scale (GCPS). These two studies showed that, compared to the general population, TMD patients have significantly more often problems impairing their OHRQoL. However, the influence of gender and age are analyzed only in a minority of studies [13]. Overall, due to the relatively low number of studies concerning TMD and quality-of-life, further studies are needed to evaluate the level of impaired OHRQoL in TMD.

The aim of the present study was to evaluate the association between a RDC/TMD Axis II profile and oral health-related quality-of-life among patients with TMD and non-patients. Secondly, the aim was to investigate the effect of gender and age on these associations.

Materials and methods

The total sample of the study consisted of 149 subjects, 79 of which (22.8% men, mean age = 43.5, SD = 13.1) were consecutive TMD patients who had been referred to the Oral and Maxillofacial Department, Oulu University Hospital, Finland, for diagnosis and treatment of TMD and 70 (32.9% men, mean age = 25.3, SD = 6.5) non-patients consisting of dental students from the University of Oulu, Finland. The inclusion criteria for the study were as follows: (1) at least one diagnosis of TMD according to the RDC/TMD [4], (2) at least 20 years of age and (3) lack of general diseases that may affect the masticatory muscle or TMJs. Eighty-six per cent of the patients were diagnosed as having myofascial pain without limited opening, 25% disc dislocation (DD) with reduction (in one or both TMJs), 9% DD without reduction with limited opening, 1% DD without reduction without limited opening, 42% arthralgia, 19% osteoarthritis and 11% osteoarthrosis.

The size of the sample was calculated with power analysis based on the data of an earlier study [14]. Variable (total score of Helkimo's clinical dysfunction index) differences with a mean of 2-points (SD = 3.5, 5% alpha error level) between the groups could be achieved with 80% power with the sample size of 39 per group.

All the subjects filled in the questionnaire which included the validated Finnish version of OHIP-14 and the Finnish translation of RDC/TMD. OHIP-14 includes seven conceptual dimensions of oral health-related quality-of-life. The dimensions are functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap [15]. These dimensions are based on the conceptual model of oral health [16]. The prevalence of OHIP was evaluated as the percentage of participants reporting at least one problem occasionally, fairly often or very often. OHIP severity was evaluated as the sum of ordinal responses, which takes into account impacts experienced only occasionally or hardly ever. The following variables were determined for every Axis II subscale of the RDC/TDM criteria:

(1) Graded Chronic Pain Scale GCPS

- grade 0 = no TMD pain in the previous 6 months,
- grade I = low disability—low intensity pain,
- grade II = low disability—high intensity pain,
- grade III = high disability—moderately limiting, and
- grade IV = high disability—severely limiting;

(2) Somatization; pain items included and pain items excluded, both graded as normal, moderate, or severe; and
(3) Depression, classified as normal, moderate, severe, based on the reference values as suggested by Dworkin and LeResche [4].

Statistical analysis

OHIP prevalence and OHIP severity were calculated for each sub-group of Axis II. The association between RDC/TMD Axis II profile sub-scales categories and OHIP prevalences was evaluated using chi-squared tests, stratified by group status and gender. One-way Anova tests were used to evaluate the statistical significances of the association between Axis II profile sub-scales categories and OHIP severity. For the logistic regression analyses, GCPS was dichotomized as grade 0 vs grades I–IV, somatization (pain items included and pain items excluded) as normal vs moderate or severe and depression as normal vs moderate or severe. Logistic regression analyses with OHIP prevalence as dependent variable and GCPS, somatization (with pain items included and pain items excluded) and depression as independent variables at time were conducted. All models were adjusted for age (continuous), gender and group. Additionally, interaction coefficients between each independent variable and group and gender were calculated. Statistical significance was set at $p < 0.05$. All statistical analyses were performed using the SPSS software, version 17.0.

Results

The mean of the facial pain symptom duration of the patient group (57 responses) was 5.8 years (SD = 8.2 years). The prevalence of OHIP was 90.9% in the patient group and 33.3% in the non-patient group ($p < 0.001$, chi-squared test). The OHIP prevalence was higher among those scoring higher on all RDC/TMD Axis II profile sub-scales. The mean OHIP severity score was 15.7 (SD = 10.5) in the patient group and 3.0 (SD = 5.5) in the non-patient group. The mean OHIP severity score was higher among those scoring higher on every RDC/TMD Axis II profile sub-scale. Mean OHIP scores differed significantly among sub-scales in the non-patient group. In the non-patient group, all Axis II sub-scales were significantly associated with OHIP prevalence and all other sub-scales except somatization (pain items included) were significantly associated with OHIP severity (Table I). In the patient group somatization sub-scale (pain items included) associated significantly with OHIP severity, which includes also an item on pain (Table I).

The mean OHIP prevalence was 67.6% among women and 56.4% in men. After stratifying by gender the OHIP prevalence was higher among those scoring higher on all RDC/TMD Axis II profile sub-scales. The mean of OHIP severity was 11.3 (SD = 11.5) in women and 6.0 (SD = 6.7) in men. The mean OHIP severity score was higher among those scoring higher on all RDC/TMD Axis II profile sub-scales. Women showed significantly higher OHIP severity scores than men on all Axis II sub-scales (Table II). Women showed statistically significant associations of OHIP prevalence with all Axis II sub-scales and also between OHIP severity and GCPS. Among men, OHIP prevalence associated with GCPS and somatization (with pain items excluded), while OHIP severity associated with GCPS and somatization (with and without pain items) (Table II).

The logistic regression analyses showed that OHIP prevalence associated significantly with somatization with pain items included (OR = 4.2, 95% CI = 1.5–11.4), somatization with pain items excluded (OR = 3.2, 95% CI = 1.1–8.9) and depression (OR = 4.7, 95%

Table I. The prevalence of Oral Health Impact Profile (OHIP) (subjects reporting at least one problem) and the mean OHIP severity according to the Axis II profile sub-scales included in the research diagnostic criteria for temporomandibular disorders (RDC/TMD) in 79 patients with TMD and 70 non-patients.

			OHIP prevalence (%)		OHIP severity	
	Patients *n* (%)	Non-patients *n* (%)	Patients	NP	Patients	NP
GCPS*						
0	25 (31.3)	45 (64.3)	84.00	20.45	12.96	1.16
I	19 (24.1)	19 (27.1)	88.89	62.50	14.17	5.06
II	33 (41.8)	6 (8.6)	96.88	50.00	18.25	10.83
III	1 (1.3)	—	100.00	—	27.00	—
IV	1 (1.3)	—	100.00	—	16.00	—
p-value**			0.539	0.006	0.278	0.000
Depression						
Normal	43 (54.4)	46 (65.7)	88.37	21.74	12.95	2.28
Moderate	21 (26.6)	14 (20.0)	100.00	64.29	19.38	3.79
Severe	12 (15.2)	6 (8.6)	91.67	50.00	20.17	6.50
p-value			0.269	0.008	0.278	0.000
Somatization (pain items included)						
Normal	27 (34.2)	45 (64.3)	85.19	22.22	12.07	1.60
Moderate	29 (36.7)	14 (20.0)	93.10	64.29	18.03	3.79
Severe	20 (25.3)	7 (10.0)	100.00	42.86	17.85	10.29
p-value			0.171	0.012	0.018	0.180
Somatization (pain items excluded)						
Normal	35 (44.3)	46 (65.7)	88.57	23.91	14.06	1.54
Moderate	24 (30.4)	16 (22.9)	91.67	56.25	15.50	4.38
Severe	17 (21.5)	4 (5.7)	100.00	50.00	20.12	14.00
p-value			0.356	0.047	0.060	0.000

*Graded Chronic Pain Status.
**p-values for differences in OHIP prevalence and OHIP severity among the groups.

Table II. The prevalence of Oral Health Impact Profile (OHIP) (subjects reporting at least one problem) and the mean OHIP severity according to the Axis II profile sub-scales included in the research diagnostic criteria for temporomandibular disorders (RDC/TMD) in 79 patients with TMD and 70 non-patients, stratified by gender.

			OHIP prevalence (%)		OHIP severity	
	Men *n* (%)	Women *n* (%)	Men	Women	Men	Women
GCPS*						
0	21 (53.8)	46 (45.1)	28.6	50.0	1.62	7.11
I	10 (25.6)	24 (23.5)	80.0	75.0	8.30	10.54
II	8 (20.5)	30 (29.4)	100.0	86.7	14.50	17.77
III	—	1 (1.0)	—	100.0	—	27.00
IV	—	1 (1.0)	—	100.0	—	16.00
p-value**			0.001	0.011	0.000	0.004
Depression						
Normal	30 (76.9)	58 (56.9)	46.7	56.9	4.87	8.66
Moderate	7 (17.9)	28 (27.5)	85.7	85.7	9.86	13.96
Severe	2 (5.1)	16 (15.7)	100.0	75.0	9.00	16.44
p-value			0.076	0.022	0.572	0.063
Somatization (pain items included)						
Normal	28 (71.8)	44 (43.1)	46.4	45.5	4.46	6.20
Moderate	9 (23.1)	34 (33.3)	77.8	85.3	9.22	14.50
Severe	2 (5.1)	24 (23.5)	100.0	83.3	12.50	16.25
p-value			0.114	0.000	0.027	0.086
Somatization (pain items excluded)						
Normal	29 (74.4)	52 (51.0)	44.8	55.8	4.34	8.40
Moderate	8 (20.5)	32 (31.4)	87.5	75.0	10.25	11.25
Severe	2 (5.1)	18 (17.6)	100.0	88.9	12.50	19.94
p-value			0.043	0.020	0.008	0.120

*Graded Chronic Pain Status.
***p*-values for differences in OHIP prevalence and OHIP severity among the groups.

CI = 1.6–13.8). No statistically significant interaction coefficient between GCPS, somatization (with pain items included and pain items excluded) and depression and group or gender was found.

Discussion

The results of the present study showed that the RDC/TMD Axis II psychosocial sub-scales associate with OHRQoL. The TMD patient group had significantly poorer OHRQoL than the non-patient group; OHIP prevalence was almost 3-times higher in the patient group than in the control group, which highlights the significance of TMD in impairment of OHRQoL. Although the patient group showed much higher OHIP prevalence and OHIP severity points on all Axis II sub-scales, statistically significant differences were seen, especially in the non-patient group on all Axis II sub-scales. Instead, the patient group showed relatively high OHIP values on every sub-scale, leading to smaller deviations between them compared to the non-patient group (Table I). Finally, the associations with OHIP prevalence and depression and somatization remained in the multivariate model.

Our results indicate that psychosocial factors are associated with TMD by impairing the OHRQoL. These results support previous studies concerning the role of psychosocial factors in the background of TMD. Rantala et al. [17,18] evaluated the association of TMD symptoms with psychosocial factors and found a significant relationship between somatization and myofascial pain. In addition, there is considerable evidence suggesting that psychological and psychosocial factors are fundamental in the understanding of TMD, as with other chronic pain disorders [1,19,20]. Somatization has already been found to be a risk factor for myofascial pain in earlier studies in patient and community samples [21,22]. Furthermore, psychosocial factors are significantly related not only to TMD but also to other musculoskeletal pain, such as neck

pain [23-26], which emphasizes the complex relationship between psychosocial issues and pain in both patient and non-patient populations.

The strongest associations were seen between OHRQoL and GCPS so that those with increasing levels of GCPS also had increasingly impaired OHRQoL (Tables I and II). Previous findings have also shown that TMD impair OHRQoL, especially through pain [9,10]. However, after controlling age and gender, this association was not significant, which indicated that the associations are influenced through these variables, possibly also via symptom duration, which could not be assessed in this study due to limited data. An interesting finding was that depression and somatization associated with OHRQoL. Thus, it can be assumed that TMD associate with OHRQoL through multiple ways, linked with depression and somatization. In our study the non-patient group showed considerably high frequency in depression and somatization rates (Table I). These levels are higher than those found in the study of Rantala et al. [18] from a Finnish working population. This may be due to the fact that our non-patient group consisted of dental students, who are supposed to experience more stress and depression than the working adult population. It should also be noted that the awareness of TMD symptoms by the dental students may have affected their report of symptoms. Furthermore, in our study we used the reference values as suggested by Dworkin and LeResche [4], whereas in the other Finnish study [18] the population was divided into three groups by percentiles according to TDC/TMD to assess depression.

Two recent studies used the same criteria as the present study in assessing TMD and OHRQoL [9,10]. In contrast to our study, the control groups in both of the studies represented a population without any signs of TMD diagnosis, which may increase the differences between the groups. In the study of John et al. [9] there were larger differences in Axis II than in Axis I sub-scales and OHRQoL had the strongest association with GCPS. In addition, somatization scores were strongly related to OHIP scores, whereas depression was only weakly related. This finding is in contrast to our results which showed significant associations also between depression subscale and OHIP scores in the non-patient group. The study of Reissmann et al. [10] concentrated on Axis I physical diagnoses, not on psychosocial sub-scales. Their results highlight the role of pain in OHRQoL. They found that myofascial pain patients showed the highest OHRQoL impact, with the lowest impact seen in patients with disc displacement. Further, subjects with pain-associated conditions presented higher scores than those without pain.

In the present study women showed higher OHRQoL scores than men (Table II). The association between OHIP and all Axis II sub-scales was statistically significant in women. Men had statistically significant associations in GCPS and somatization. Additionally, women had higher values on GCPS compared with men (Table II). The differences in pain mechanisms between genders have been explained by multiple factors, such as biological, hormonal, psychosocial and social factors [19,27-31]. The patients in the study sample had been referred to specialist dental healthcare at Oulu University Hospital, meaning that they had mostly suffered from long-standing and severe symptoms of TMD. In both genders OHRQoL was impaired by chronic pain. In addition, OHRQoL was associated with depression in women and with somatization in both genders. Depression impairs OHRQoL, especially in women, who also showed higher depression values than men. The role of depression in the background of TMD has been shown especially among women [30]. Further, women have been shown to be exposed to more complex neurophysiological mechanisms between pain and depression compared with men [32].

The strength of the present study was that we used valid and standardized instruments in the measurement of TMD-related psychosocial aspects and OHRQoL. In order to evaluate the associations both in TMD patients and the general population we used two different groups of subjects, TMD patients and non-patients. In contrast to the study by John et al. [9], in our study no TMD cases were excluded from the control group, and the controls can thus be regarded as representing normal population. It should be noted that the mean ages of the subjects in the TMD patient and non-patient groups were not consistent (43.5 and 25.3 years, respectively). In addition, the gender distribution differed between the groups in that the non-patient group included larger percentages of men than the patient group. The influences of age, gender and group status were controlled for in the multivariate analysis. The relatively wide confidence intervals are supposed to be due to the low sample size.

In conclusion, TMD associate with oral health-related quality-of-life by multiple ways, especially through depression and somatization. In addition, these findings emphasize the importance of early and effective treatment of TMD. Dentists should also evaluate and be prepared to manage the psychosocial aspects of TMD patients or consult mental healthcare professionals on the appropriate treatment of TMD.

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References

[1] Okeson JP. Management of temporomandibular disorders and occlusion. St Louis, MO: Mosby; 2008, p. 129–64.

[2] LeResche L. Epidemiology of temporomandibular disorders: implications for investigation of etiologic factors. Crit Rev Oral Biol Med 1997;8:291–305.

[3] Dworkin SF, Huggins KH, LeResche L, Von Korff M, Howard J, Truelove E, et al. Epidemiology of signs and symptoms in temporomandibular disorders: clinical signs in cases and controls. J Am Dent Assoc 1990;120:273–81.

[4] Dworkin SF, LeResche L. Research diagnostic criteria for temporomandibular disorders: review, criteria, examinations and specifications, criteria. J Craniomand Disord Facial Oral Pain 1992;6:301–55.

[5] Suvinen TI, Reade PC, Kemppainen P, Könönen M, Dworkin SF. Review of aetiological concepts of temporomandibular pain disorders: towards a biopsychosocial model for integration of physical disorder factors with psychological and psychosocial illness impact factors. Eur J Pain 2005;9:613–33.

[6] Locker D, Allen F. What do measures of 'oral health-related quality of life' measure? Community Dent Oral Epidemiol 401–11.

[7] Murray H, Locker D, Mock D, Tenenbaum HC. Pain and the quality of life in patients referred to a craniofacial unit. J Orofac Pain 1996;10:316–23.

[8] Segu M, Collesano V, Lobbia S, Rezzani C. Cross-cultural validation of a short form of the Oral Health Impact Profile for temporomandibular disorders. Community Dent Oral Epidemiol 2005;33:125–30.

[9] John MT, Reissmann DR, Schierz O. Oral health-related quality of life in patients with temporomandibular disorders. J Orofac Pain 2007;21:46–54.

[10] Reissmann DR, John MT, Schierz O, Wassell RW. Functional and psychosocial impact related to spesific temporomandibular disorders diagnoses. J Dent 2007;35:643–50.

[11] Rener-Zitar K, Celebic A, Stipetic J, Marion L, Petricevic N, Zaletel-Kragelj L. Oral health related quality of life in Slovenian patients with craniomandibular disorders. Coll Antropol 2008;2:857–66.

[12] Barros V de M, Seraidarian PI, Cortes MI, de Paula LV. The impact of orofacial pain on the quality of life in patients with temporomandibular disorder. J Orofac Pain 2009;23:28–37.

[13] Dahlström L, Carlsson GE. Temporomandibular disorders and oral health-related quality of life. A systematic review. Acta Odontol Scand 2010;68:80–5.

[14] Sipilä K, Zitting P, Siira P, Laukkanen P, Järvelin MR, Oikarinen KS, et al. Temporomandibular disorders, occlusion, and neck pain in subjects with facial pain: a case-control study. J Craniomand Pract 2002;20:158–64.

[15] Slade GD, Spencer AJ. Development and evaluation of the Oral Health Impact Profile. Community Dent Health 1994;11:3–11.

[16] Locker D. Measuring oral health: a conceptual framework. Community Dent Health 1988;5:3–18.

[17] Rantala MAI, Ahlberg J, Suvinen TI, Savolainen A, Könönen M. Symptoms, signs, and clinical diagnoses according to the Researh Diagnostic Criteria for Temporomandibular Disorders among Finnish multiprofessional media personnel. J Orofac Pain 2003;17:311–16.

[18] Rantala MA, Ahlberg J, Suvinen TI, Savolainen A, Könönen M. Chronic myofascial pain, disk displacement with reduction and psychosocial factors in Finnish non-patients. Acta Odontol Scand 2004;62:293–7.

[19] LeResche L. Assessment of physical and behavioural outcomes of treatment. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1997;83:82–6.

[20] Sipilä K, Veijola J, Jokelainen J, Järvelin MR, Oikarinen KS, Raustia AM, et al. Association of symptoms of TMD and orofacial pain with alexithymia: an epidemiological study of the Northern Finland 1966 Birth Cohort. J Craniomandib Pract 2001;19:246–51.

[21] 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.

[22] Huang GJ, LeResche L, Critchlow CW, Martin MD, Drangsholt MT. Risk factors for diagnostic subgroups of painful temporomandibular disorders (TMD). J Dent Res 2002;81:284–8.

[23] Linton SJ. A review of psychosocial risk factors in back and neck pain. Spine 2000;25:1148–56.

[24] Ariens GA, van Mechelen W, Bongers PM, Bouter LM, van der Wal G. Psychosocial risk factors for neck pain: a systematic review. Am J Ind Med 2001;39:180–93.

[25] Ariens GA, Bongers PM, Hoogendoorn WE, Houtman IL, van der Wal G, van Mechelen W. High quantitative job demands and low co-worker support as risk factors for neck pain: results of a prospective cohort study. Spine 2001;26: 1896–901.

[26] Bongers PM, de Winter CR, Kompier MA, Hildebrandt VH. Psychosocial factors at work and musculoskeletal disease. Scand J Work Environ Health 1993;19:297–312.

[27] Dao TT, LeResche L. Gender differences in pain. J Orofac Pain 2000;14:169–84.

[28] Klineberg I, McGregor N, Butt H, Dunstan H, Roberts T, Zerbes M. Chronic orofacial muscle pain: a new approach to diagnostic and management. Alpha Omegan 1998;91:25–8.

[29] Macfarlane TV, Blinkhorn AS, Davies RM, Kincey J, Worthington HV. Association between female hormonal factors and oro-facial pain: study in the community. Pain 2002; 97:5–10.

[30] McGregor NR, Zerbes M, Niblett SH, Dunstan RH, Roberts TK, Butt H, et al. Pain intensity, illness duration, and protein catabolism in temporomandibular disorder patients with chronic muscle pain. J Orofac Pain 2003;17: 112–24.

[31] Rollman GB, Lautenbacher S. Sex differences in musculoskeletal pain. Clin J Pain 2001;17:20–4.

[32] Sipilä K. Temporomandibular disorders (TMD) and depression. In Hernandez P, Alonso S, editors. Women and depression. Hauppauge, NY: Nova Science Publishers; 2008.