Assessment of Pain Drawings and Self-Reported Comorbid Pains as Part of the Biopsychosocial Profiling of Temporomandibular Disorder Pain Patients

Tuija I. Suvinen, DDS, PhD
Senior Researcher
Institute of Dentistry
University of Turku
Turku, Finland
and University of Eastern Finland
Kuopio, Finland

Pentti Kemppainen, DDS, PhD
Professor
Department of Stomatognathic Physiology
Institute of Dentistry
University of Turku
Department of Oral Diseases
Turku University Hospital
Turku, Finland
Clinicum
Department of Oral Sciences
Oral and Maxillofacial Surgery Outpatient Clinic
Helsinki University Hospital
University of Helsinki
Helsinki, Finland

Yrsa Le Bell, DDS, PhD
Professor
Department of Stomatognathic Physiology
Institute of Dentistry
University of Turku
Department of Oral Diseases
Turku University Hospital
Turku, Finland

Tommi Kauko, MSc
Biostatistician
Department of Clinical Medicine and Biostatistics
University of Turku
Turku, Finland

Heli Forssell, DDS, PhD
Associate Professor
Department of Oral and Maxillofacial Surgery
Institute of Dentistry
University of Turku
Turku, Finland

Correspondence to:
Tuija I. Suvinen
Institute of Dentistry
University of Turku, Turku, Finland
Lemminkäisenkatu 2, FI-20520 Turku, Finland
Fax: +35823338399
Email: tuija.suvinen@utu.fi

Aims: To assess drawings of pain sites and self-reported comorbid pains as a part of the biopsychosocial profiling of tertiary care referral patients with temporomandibular disorder (TMD) pain. **Methods:** A total of 135 consecutive patients referred to tertiary care for TMD pain participated. Patients drew all the sites where they had pain on whole-body pain drawings. Other assessments included self-reported comorbid pains in the head and body regions, the Finnish Research Diagnostic Criteria for TMD (RDC/TMD_FIN Axis II), and additional biopsychosocial and treatment-related variables. Patients were grouped into pain drawing profiles (localized, regional, and widespread) and the associations between these profiles and the biopsychosocial variables were statistically evaluated using Bonferroni adjusted *P* values and with logistic regression using SAS 9.3. **Results:** A total of 21% of the patients reported localized TMD pain, 20% reported regional pain (headaches and neckaches), and the majority, 59%, reported widespread pain (local/regional and multiple bodily pain sites). Patients with widespread pain profiles formed a heterogenous group in which 28.2% reported severe and 30.8% reported moderate pain-related disability. The widespread pain patients reported significantly higher levels of depression and somatization, lower levels of general health, more sleep dysfunction, decreased ability to control pain, and greater health care needs compared to patients with localized pain ($P < .05$). Patients with regional pain profiles reported moderate scores on psychosocial functioning compared to the patients with localized or widespread pain. **Conclusion:** The majority of tertiary care referral patients with TMD pain reported comorbid pains. Pain drawings were found a useful adjunctive tool for screening and as a part of comprehensive biopsychosocial assessment and treatment planning for patients with TMD pain. *J Oral Facial Pain Headache 2016; 30:287–295. doi: 10.11607/ofph.1589*

Keywords: *biopsychosocial assessment, comorbid pain, coping, health care use, pain, pain drawing, RDC-TMD Axis II*

Temporomandibular disorders (TMD) comprise a set of conditions affecting the masticatory muscles, the temporomandibular joints (TMJs), or both.[1] Pain is considered the main symptom that drives patients to seek treatment and is an important component in TMD diagnostics and treatment planning.[1] The prognosis of TMD is usually favorable, but up to 30% of cases may progress to persistent pain problems.[2,3]

According to current concepts, TMD pain should be viewed as a biopsychosocial problem; ie, TMD pain is associated with both somatic and psychosocial elements.[4,5] Much of the TMD research up to the recent decade has focused on peripheral disease-specific factors, but at present it is considered more appropriate to explore a wide range of person-specific factors in early assessment, as these factors may contribute to the overall presentation of individual TMD pain.[6] These assessments include comorbid pain conditions and many interrelated factors that may influence pain perception and appraisal, such as psychological distress and psychosocial functioning. These factors should be considered a basis for individualized treatment planning.[6,7]

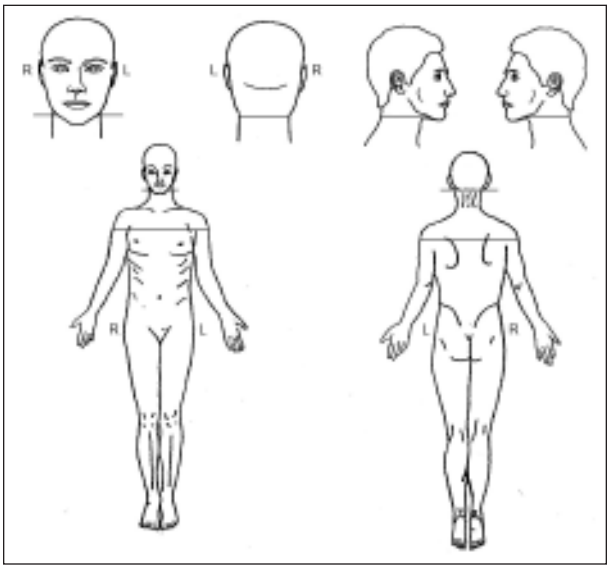

Fig 1 Pain drawing with the assessment template outlines for PD-1, PD-2, and PD-3 subgroups. *Patient instructions:* Please draw ALL pain sites where you have pains.

It is well known that patients with TMD pain also frequently report pain in other body regions; eg, headaches, neck and shoulder pain, and widespread pain such as fibromyalgia.[8–12] There is increasing evidence that comorbid pains may be related to the onset and chronicity of TMD pain as well as to treatment outcome.[6,13–17] While pain drawing is commonly used in other chronic musculoskeletal pain assessment, there is not much literature related to its use in TMD pain.[18] It is however noteworthy that pain drawing is now included as one of the assessment tools in the recently published Diagnostic Criteria for Temporomandibular Disorders (DC/TMD).[1]

The primary aim of this study was to assess pain drawings in screening and as a part of the biopsychosocial profiling and treatment planning of patients referred to tertiary care for TMD pain. A related objective was to compare patients with localized, regional, and widespread pain profiles in order to examine the association of these three pain drawing profiles with patient-reported comorbid pains, level of general health, and psychosocial, patient-perceived, and treatment-related variables. The study hypotheses were *(1)* that drawings of whole-body pain sites can be used to assess the comorbidity of other pains and *(2)* that TMD pain patients with localized, regional, or widespread pain profiles vary in their biopsychosocial profiles, thus making pain drawings a useful adjunctive tool in comprehensive assessment and treatment planning.

Materials and Methods

Study Sample

This study was based on consecutive patients (n = 135) referred because of their TMD pain to the tertiary care specialist unit in the Department of Oral Diseases of Turku University Hospital over a 2-year period in 2010 to 2011. The inclusion criteria were: TMD pain in the past 6 months in the temporomandibular region according to the Finnish Research Diagnostic Criteria for TMD (RDC/TMD_Fin).[19] The research protocol was approved by the ethics committee of the university hospital. More details regarding the recruitment process and the TMD subtyping of these patients were provided in a previous publication.[20] All patients providing informed consent were assessed in a standardized way by three senior TMD/orofacial pain specialists and completed a comprehensive multidimensional questionnaire, which included the following methods.

Methods

Pain Drawing

Patients drew all the sites in the face, head, and whole-body regions where they had pain on a standardized depiction of the body regions as illustrated in Fig 1. The drawings were verified for accuracy by the TMD/orofacial pain specialists during the first clinical assessment visit; ie, patients were interviewed to confirm that they had shaded in all pain areas (see patient instructions in Fig 1).

TMD Pain Patient Subgroups Based on Pain Drawing Profiles

Patients with TMD pain were grouped into three pain drawing (PD) profile subgroups: PD-1, PD-2, and PD-3. Grouping was according to Türp et al[21] and Stohler[22] as follows: PD-1 = localized pain in the head and trigeminal regions; PD-2 = regional pain in the trigeminal-cervical region (including head and neck/shoulder regions); and PD-3 = widespread pain (including local/regional and multiple bodily pain sites outside the areas of PD-1 and PD-2). All of the pain drawings were independently evaluated by the first author using a transparent assessment template to ensure that all patients were correctly allocated into one of the PD subgroups (see template outlines in Fig 1).

Comorbid Pain Problems

Patients completed self-report questions regarding whether they had any of the following comorbid pain problems: head pain, neck pain, back pain, stomach pain, chest pain, and other pains (range of possible scores was 0–6, with 1 = yes and 0 = no per site). The associations between these self-reported comorbid pains and the PD subgroups were evaluated statistically.

RDC/TMD_FIN Axis II Assessments

The Axis II assessments[19] included *(1)* the Graded Chronic Pain Scale (GCPS) for the assessment of pain intensity (range 0–100) and pain-related interference (disability days and disability score; range 0–6) and *(2)* the Symptom Checklist-90 Revised (SCL-90R) for the assessment of symptoms of depression and somatization with and without pain items. The GCPS was used to derive GCPS grades similar to Dworkin et al[23,24] and TMD subtypes in a previous study[20]; the grades were as follows: GCPS grades I and II-Low (TMD subtype 1) with low pain intensity (CPI < 50) and no disability points, GCPS grade II-High (TMD subtype 2) with high pain intensity (CPI ≥ 50) and 1–2 disability points, and GCPS grades III and IV (TMD subtype 3) with 3–4 disability points, moderately limiting, and 5–6 disability points, severely limiting. The SCL-90R scale scores for depression included 20 questions; the somatization with pain items included 12 questions and the somatization without pain items 7 questions (range 0–4). A more detailed presentation of the TMD subtypes in this study sample was presented in a previous publication.[20]

Additional Biopsychosocial Assessments

Assessments were also made of the level of general health, pain-related worry, sleep dysfunction, and the ability to control or decrease pain. Patient-perceived general health status was rated on a 5-point scale (Likert scale; 1 = excellent, 5 = poor). Pain-related worry was rated on a 10-point scale (numeric rating scale; 0 = not at all worried, 10 = extremely worried).[25] Patients' level of sleep dysfunction was rated on the average score of 3 SCL-90R questions measuring sleep disturbance ("difficulty falling asleep," "restless sleep," and "early morning awakening"; 0 = not at all, 4 = extremely). Coping questions were derived from the Coping Strategies Questionnaire[26] and measured perceived ability to control pain (0 = no control, 6 = complete control) or the ability to decrease pain (0 = can't decrease at all, 6 = can decrease completely).

Treatment-Related Assessments

The treatment-related assessments included the total number of all previous consultations for TMD pain (dentists and/or physicians). Patients were also asked to indicate their self-perceived treatment goals and the need to obtain information about their pain problems and/or to improve pain control, jaw function, daily functioning, and stress management (0 = no, 1 = yes). Additionally, patients were asked to indicate how important it would be that their treatment program included treatments that focused on physical, oral functional and/or stress, and emotional upset factors (the Explanatory model scale-FIN; 0 = not at all important, 4 = extremely important).[27,28]

Statistical Analyses

Categorical and continuous variables are summarized as counts (n) and proportions (%) and as medians and interquartile ranges (IQR), respectively. The categorical variables were evaluated using the Chi-square test or Fisher's exact test. The Kolmogorov-Smirnov test was used to check normality. Continuous variables were analyzed with the Kruskal-Wallis test, and pairwise comparisons with the Mann-Whitney U-test using Bonferroni adjusted *P* values. Differences in the localized, regional, and widespread PD subgroups (PD subgroups as dependent variables) were further analyzed using logistic regression for all independent self-reported comorbid pains, Axis II, and additional biopsychosocial variables in the models. Results are expressed using odds ratios (ORs) with 95% confidence intervals (CIs). *P* values of post hoc pairwise comparisons in the logistic models were adjusted using the Šidák or Tukey-Kramer method. Statistical analyses were done using the SAS System for Windows, Version 9.4 (SAS Institute). *P* values less than .05 were considered statistically significant.

Results

Demographic Data of the Study Sample

The mean age and standard deviation (SD) of the patients (n = 135) in this study sample was 45.3 ± 15.2 years and the majority (78%) of the subjects were female. The majority of the patients had received higher education (59%), were married (78%), and were employed (54%). There were no significant PD subgroup differences in educational level or marital status. A significantly higher proportion of the PD-3 patients were unemployed (31%) compared to the PD-1 (6%) and PD-2 (9%) patients (*P* < .04).

TMD Pain Data in the PD Subgroups

A total of 21% of the patients reported localized pain (PD-1), 20% reported regional pain (PD-2), and the majority, 59%, reported widespread (PD-3) pain; ie, multiple bodily pain sites were associated with their TMD pain. No significant subgroup differences were found in the pain intensity variables (including the level of present, worst, and average pain intensity). The PD-3 patients reported significantly longer duration of TMD pain compared to PD-1 patients (7.6 ± 9.5 years vs 2.7 ± 5.4 years; *P* < .01).

Comorbid Pain Problems

The most prevalent self-reported comorbid pains included headaches and neckaches and back pain (Table 1). The PD-2 and PD-3 patients reported significantly more headaches and neckaches than the PD-1 subgroup. The PD-3 patients reported the

Table 1 Percent Distribution of Self-Reported Comorbid Pains Within Each PD Subgroup and in the Total Sample and Significant PD Subgroup Differences

Comorbid pains		PD-1	PD-2	PD-3	Total	P*	OR	95% CI	P#
Headache	%	30.8	75.0	85.1	71.0				
PD-2 vs PD-1						.0068	6.8	1.95–23.4	**.0026**
PD-3 vs PD-1						< .0001	12.8	4.4–37.4	**< .0001**
PD-3 vs PD-2						NS	1.9	0.6–5.96	NS
Neckache	%	19.2	88.5	84.1	71.1				
PD-2 vs PD-1						< .0001	32.2	6.8–151.5	**< .0001**
PD-3 vs PD-1						< .0001	22.1	6.9–71.3	**< .0001**
PD-3 vs PD-2						NS	0.7	0.2–2.7	NS
Back pain	%	12.5	33.3	88.1	60.9				
PD-2 vs PD-1						NS	3.5	0.8–15.3	NS
PD-3 vs PD-1						< .0001	51.6	12.5–213.0	**< .0001**
PD-3 vs PD-2						< .0001	14.8	4.8–45.4	**< .0001**
Combined/other	%	12.5	30.8	65.5	45.4				
PD-2 vs PD-1						NS	3.1	0.7–13.5	NS
PD-3 vs PD-1						< .0001	13.3	3.5–50.1	**< .0001**
PD-3 vs PD-2						.0130	4.3	1.6–11.5	**.0042**
Total no. of sites (0–6)	Median (IQR)	0 (0–1.5)	2 (2–4)	4 (3–5)					
PD-2 vs PD-1						< .0001	4.2	2.1–8.2	**< .0001**
PD-3 vs PD-1						< .0001	7.9	3.8–16.4	**< .0001**
PD-3 vs PD-2						.0001	1.9	1.3–2.7	**< .0001**

*Pairwise comparisons with Mann-Whitney U-test using Bonferroni adjusted *P* values.
#Logistic regression models with odds ratios (ORs) and 95% confidence intervals (CIs). Significant PD subgroup differences are indicated in bold.
NS = not significant; IQR = interquartile range.

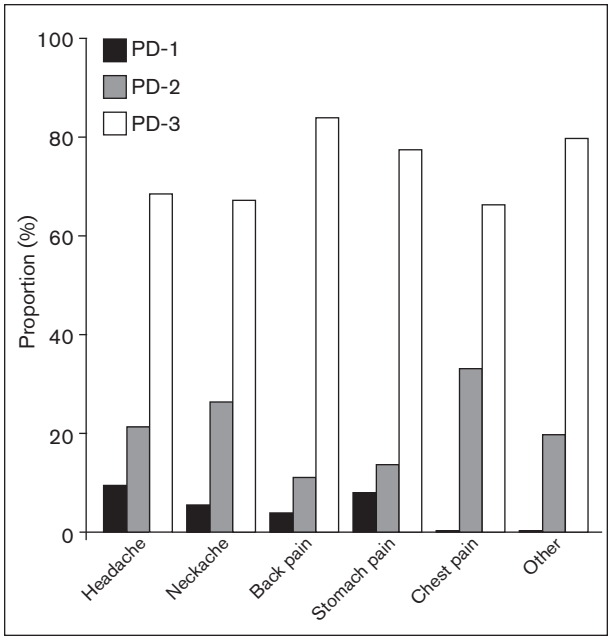

Fig 2 The relative proportions of comorbid pains reported by patients in each PD subgroup.

highest number of comorbid pains: significantly more back pain and combined other comorbid pains (including stomachache, chest pain, and other pains). The PD-1 patients reported the significantly lowest total number of comorbid pains compared to the PD-2 and PD-3 subgroups.

Further analysis by logistic regression indicated an overall significance for the prevalence of headaches, neckaches, back pain, and combined other pains ($P < .0001$). Significantly increased ORs were found for headache and neckache comorbidities in the PD-2 and PD-3 patients compared to PD-1 patients (Table 1). PD-3 patients reported significantly higher ORs for back pain and combined other comorbid pains compared to the PD-1 and PD-2 patients. Therefore, the risk of belonging to PD-2 rather than PD-1 was higher for patients reporting headaches and neckaches, and the risk of belonging to PD-3 rather than PD 1–2 was higher for patients reporting back pain and other bodily comorbid pains. The proportions of all self-reported comorbid pains reported in each PD subgroup are presented in Fig 2.

RDC/TMD_FIN Axis II Psychosocial Assessment

The majority (64.3%) of the PD-1 patients belonged to TMD subtype 1, and most (51.9%) of the PD-2 patients belonged to TMD subtype 2. The majority (59%) of the PD-3 patients were in TMD subtypes 2 or 3. A significant difference was found in disability points between PD-3 and PD-1 patients ($P < .05$), but PD-3 and PD-2 patients reported similar levels of TMD pain–related disability points. The PD-3 patients reported significantly higher levels of depression and somatization compared to the PD-1 subgroup and the PD-2 patients reported moderate depression and somatization scores (Table 2).

Table 2 RDC/TMD_FIN[19] Assessment Data and Significant PD Subgroup Differences

Axis II variables		PD-1	PD-2	PD-3	Total	*P**	OR	95% CI	*P*#
TMD subtypes									**.0445****
Subtype 1	%	64.3	33.3	41.0	44.4				
PD-2 vs PD-1						.0217	0.50	0.22–1.11	NS
PD-3 vs PD-1						.0344	1.78	1.00–3.17	NS
PD-3 vs PD-2						NS	3.56	1.70–7.45	.0008
Subtype 2	%	21.4	51.9	30.8	33.1				
PD-2 vs PD-1						.0190	2.33	0.90–6.07	NS
PD-3 vs PD-1						NS	4.00	1.64–9.79	.0024
PD-3 vs PD-2						.0494	1.71	0.89–3.31	NS
Subtype 3	%	14.3	14.8	28.2	22.6				
PD-2 vs PD-1						NS	1.00	0.25–4.00	NS
PD-3 vs PD-1						NS	5.50	1.90–15.96	.0017
PD-3 vs PD-2						NS	5.50	1.90–15.96	.0017
Disability points	Median (IQR)	0 (0–1.5)	1 (0–2)	1 (0–3)	1 (0–2)				NS
PD-2 vs PD-1						NS			
PD-3 vs PD-1						.0481			
PD-3 vs PD-2						NS			
SCL-90R: Depression	Median (IQR)	0.2 (0.05–0.45)	0.7 (0.2–1.2)	1 (0.42–1.75)	0.6 (0.3–1.6)				**.0003****
PD-2 vs PD-1						.0148	3.94	1.29–12.05	.0164
PD-3 vs PD-1						< .0001	7.40	2.59–21.14	.0002
PD-3 vs PD-2						NS	1.88	1.02–3.46	.0419
SCL-90R: Somatization with pain items	Median (IQR)	0.3 (0.08–0.58)	0.7 (0.5–1.08)	1.5 (0.92–1.82)	0.9 (0.6–1.6)				**< .0001****
PD-2 vs PD-1						.0011	20.83	3.37–130.82	.0011
PD-3 vs PD-1						< .0001	194.9	27.71–n/a	< .0001
PD-3 vs PD-2						< .0001	9.29	3.19–27.09	< .0001
SCL-90R: Somatization without pain items	Median (IQR)	0.3 (0.14–0.57)	0.6 (0.14–0.71)	1.2 (0.71–1.71)	0.8 (0.4–1.4)				**< .0001****
PD-2 vs PD-1						NS	5.88	1.34–25.64	.0191
PD-3 vs PD-1						< .0001	38.16	8.73–166.85	< .0001
PD-3 vs PD-2						< .0001	6.50	2.50–16.90	.0001

*Pairwise comparisons with Mann-Whitney U-test using Bonferroni adjusted *P* values.
#Logistic regression models with odds ratios (ORs) and 95% confidence intervals (CIs). Overall significant *P* values** are indicated in bold.
NS = not significant; IQR = interquartile range.

Further analysis by logistic regression indicated an overall significance for TMD subtypes and SCL-90R depression and somatization scale scores (Table 2). The risk of belonging to PD-3 vs PD-1 or PD-2 was higher for patients reporting elevated TMD pain–related disability and elevated symptoms of depression and somatization, and PD-1 patients reported lower Axis II scores compared to PD-2 and PD-3 patients.

Additional Biopsychosocial Variables

The majority (86%) of TMD patients reporting poor general health belonged to the PD-3 subgroup. These patients also reported significantly higher scores in sleep dysfunction and significantly lower scores in the perceived ability to control their TMD pain compared to the PD-1 subgroup. All patients reported relatively high scores in pain-related worry. The PD-2 patients reported moderate scores in sleep dysfunction and perceived coping ability (Table 3).

Further analysis by logistic regression indicated an overall significance for perceived general health, sleep dysfunction, and the perceived ability to control pain (Table 3). The risk of belonging to PD-3 rather than PD-1 was higher for patients reporting poor general health or more sleep dysfunction, and PD-1 patients reported less sleep dysfunction and better self-perceived ability to control pain compared to both PD-2 and PD-3 patients.

Treatment-Related Variables

The PD-3 and the PD-2 patients reported twice the number of previous consultations compared to those with localized pain in PD-1 (with an average number of 6.6 and 5.9 consultations in the PD-3 and PD-2 subgroups, respectively, vs 2.5 in the PD-1 subgroup). No significant subgroup differences were found in the patient-perceived treatment needs that focused on physical and jaw functional factors, but the PD-3 patients reported a greater need for treatments that also addressed stress and emotional factors. These patients also reported significantly greater need to improve their work ability and stress management skills ($P < .05$) as their perceived current treatment goals.

Table 3 Additional Biopsychosocial Assessment Data and Significant PD Subgroup Differences

		PD-1	PD-2	PD-3	Total	*P**	OR	95% CI	*P*#
Perceived general health status	% with poor health	4.7	9.3	86.0	32.6				**.0002****
PD-2 vs PD-1						NS	2.26	0.38–13.51	NS
PD-3 vs PD-1						< .0001	12.0	2.67–54.2	.0012
PD-3 vs PD-2						.0024	5.32	1.68–16.83	.0045
Sleep dysfunction	Median (IQR)	0.3 (0–1.2)	1 (0.3–2.3)	1.7 (0.7–2.7)	1.3 (0.3–2.3)				**.0026****
PD-2 vs PD-1						NS	2.03	1.12–3.68	.0194
PD-3 vs PD-1						.0006	2.55	1.49–4.35	.0007
PD-3 vs PD-2						NS	1.25	0.86–1.83	NS
Pain-related worry	Median (IQR)	7 (4–8)	7 (4–8)	7 (4–9)	7 (4–8)				NS
PD-2 vs PD-1						NS			
PD-3 vs PD-1						NS			
PD-3 vs PD-2						NS			
Ability to control pain	Median (IQR)	5 (4–5.5)	4 (3–5)	4 (3–5)	4 (3–5)				**.0288****
PD-2 vs PD-1						NS	0.63	0.40–0.99	.0466
PD-3 vs PD-1						.0206	0.58	0.39–0.87	.0079
PD-3 vs PD-2						NS	0.93	0.66–1.30	NS
Ability to decrease pain	Median (IQR)	3 (2.3–4)	4 (3–4)	4 (2–4.5)	4 (3–4)				NS
PD-2 vs PD-1						NS			
PD-3 vs PD-1						NS			
PD-3 vs PD-2						NS			

*Pairwise comparisons with Mann-Whitney U-test using Bonferroni adjusted *P* values.
#Logistic regression models with odds ratios (ORs) and 95% confidence intervals (CIs). Overall significant *P* values** are indicated in bold.
NS = not significant; IQR = interquartile range.

Discussion

The drawings of whole-body pain sites used in the present study were found to be a simple adjunctive clinical and research tool for identifying comorbid pains in patients with TMD pain. The three PD subgroups in this study, PD-1 (localized), PD-2 (regional), and PD-3 (widespread), were significantly associated with the number of self-reported comorbid pains reported in the corresponding body regions. The three PD subgroups also indicated differences in biopsychosocial adaptation, previous health care use, and self-perceived treatment needs and goals. Thus, the data supported the use of drawings of whole-body pain sites as an adjunctive indicator to help identify TMD pain patients with comorbid pains and compromised biopsychosocial profiles for more comprehensive assessment and treatment planning, in line with the new DC/TMD criteria.[1]

Although pain drawings have been used commonly in the assessment of other musculoskeletal and chronic pain conditions such as back pain,[18,29] there are surprisingly few studies using this method in facial or TMD pain patients. In the present study, 59% of the patients presented with widespread pain profiles, 20% with regional pain in the head and neck/shoulder regions, and 21% reported localized pain in the facial and head regions. In a study of 200 patients with persistent musculoskeletal facial pain by Turp et al[21] with three similar subgroups, the corresponding percentages were almost identical: 65.5%, 16%, and 18.5%, respectively, and like the findings in the present study, patients with widespread pain profiles reported longer pain duration compared to those with localized TMD pain profiles. Previous studies have indicated the validity and reproducibility and test-retest accuracy in the use of pain drawings, but this was not reevaluated in this cross-sectional study.[30,31] Furthermore, some studies have used scanning or other more extensive methods to assess more precisely the distribution of pain sites in the drawings of whole-body pain sites.[21,32,33] Nevertheless, the relatively simple subgrouping assessments used in the present study are in line with previous studies, which have reported fairly similar delineation of pain drawings in their evaluations.[21,32] Further studies are clearly indicated to test this method in various clinical settings, especially for the regional and widespread profile subgroups.

Self-reported comorbid pains were also frequent in the questionnaire-based evaluation, as 71.1% of the patients in the study reported headaches or neckaches, 60.9% reported back pain, and 45.4% reported other comorbid pains. Several epidemiologic and clinical studies have reported that comorbid pains are common among TMD pain patients.[9,10,34–38] In two recent reviews, Velly et al[7,12] reported that the prevalence of headaches can vary from 12% to 69% and the prevalence of neck and back pains from 16% to 68% in patients with TMD pain. In the present study, the majority of the PD-2 and PD-3 subgroups reported headaches. In addition, about one-third of

the PD-1 patients also reported headaches. Cross-sectional and case-control studies have indicated a relative risk of about 1.5 to 8.8 for headache comorbidity in TMD pain patients[7] and several studies have explored the association between TMD and headaches.[10,38–41] Tension-type headaches especially have been shown to share many symptoms with TMD, but there is still uncertainty about their underlying pathophysiologic mechanisms.[39–41] The latest update of the International Classification of Headache Disorders recognizes headache attributed to TMD as a specific headache entity.[42] Therefore, there is ample support for the paradigm shift in the new DC/TMD Axis I pain disorder diagnostics that now include TMD-related headache as a distinct TMD pain subdiagnosis.[1]

In the present study, the majority of the PD-2 and PD-3 patients reported neckaches. This seems to indicate that the trigeminal and cervical regions are probably in some cases interrelated, as reported in general population and clinic samples.[9,11,36,43,44] Over half of the sample in the present study reported widespread pain with, on average, three to five comorbid pains. This result may reflect the patient cohort being tertiary care referrals, but is in line with various epidemiologic and clinical studies.[9,11,34,45–48] Overall, evaluations regarding comorbidity between TMD and other musculoskeletal and chronic pain conditions are clinically very relevant, as it has been shown that comorbid pains can be involved in the onset, persistence, and prognosis of TMD pain.[15–17,49] This has been explained to be caused by many interrelated factors, ranging from peripheral mechanisms to central pain processing and the genetic vulnerability of the pain patients.[50–52]

The present findings also indicated an association between comorbid pains and psychosocial functioning, as the majority of the PD-2 and PD-3 patients reported compromised psychosocial adaptation. This is an extension of a previous TMD pain patient subtyping study.[20] The present study, with its focus on whole-body pain drawing profiles and a questionnaire evaluating comorbid pains, has provided further support for the subdivision of the GCPS grades to include GCPS grade II-High (with high pain intensity and low pain-related disability); ie, TMD subtype 2.[20] In the present study, over half of the tertiary care referral patients with regional pain and one-third with widespread pain profiles belonged to this intermediate TMD subtype 2; ie, were relatively well-functioning patients with only moderately compromised psychosocial profiles. The majority of the psychosocially most vulnerable TMD subtype 3 patients reported widespread pain profiles, which supports comorbid pains and widespread pain being risk factors for dysfunctional pain.[3,7,34,53] The PD-2 and PD-3 patients also formed a heterogenous group, since about one-third were psychosocially non-dysfunctional based on GCPS grades; ie, they belonged to TMD subtype 1. Several other potential biopsychosocial factors were also identified that could be involved in TMD pain complexity, including poor general health, elevated depression and somatization, sleep dysfunction, and decreased coping ability, similar to findings in a previous study[20] and consistent with findings in other studies.[2,3,9,44,53–55] It is anticipated that future studies will also reveal even more information on additional methods to identify patients with varying phenotypic risk factors.[56–60]

The three profile subgroups of the present study also differed in treatment-related variables, as patients with PD-2 and PD-3 profiles reported more health care utilization and a need for more comprehensive care. This finding supports the current paradigm shift in treatment planning, which should be based on broader assessment of patient-reported variables.[1,6] The multidimensional assessment methods used in this study indicated that patients with widespread pain profiles viewed stress- and work-related and emotional factors as important in the treatment of their TMD pain, similar to findings in some previous clinical and epidemiologic studies.[5,20,34,61] It could be tentatively hypothesized that TMD pain patients with localized symptoms in the trigeminal region may benefit from information and conservative treatment, whereas patients with regional pain may require broader treatment strategies. Patients with widespread pain possibly need more comprehensive care and some may benefit from early referral to multidisciplinary care programs. Further treatment-related studies are clearly warranted to address this possibility.

Some limitations of the present study should be noted. First, some discrepancy was noted when self-reported data in the pain drawings were compared to that in the questionnaire-based evaluations of comorbid pains, which indicates that pain drawing is not an exact method for collecting data on all comorbid pains. Furthermore, as a cautionary note, an approach based on pain drawing should not be used as the sole method to identify psychosocial associations or as a psychological screener, and data in the drawings should not be overinterpreted,[62] as is also recommended in a systematic review of the pain drawing literature.[18] Second, headaches were very frequently reported in the present study, but these were not assessed according to the updated diagnostic criteria.[1,42] Therefore, more studies applying these new criteria are warranted. Furthermore, the results indicated that the PD-2 and PD-3 subgroups formed a heterogenous sample of patients, some of which probably had comorbid pains that were less psychosocially burdening. More sophisticated methods in pain drawing analyses could reveal more information, especially among patients with widespread

pain since this subgroup may include further subgroups such as fibromyalgia-type or polyarthritis-type comorbid pains. The present study was also limited in terms of generalizability since the sample was biased toward more chronic or persistent pain patients. Also, the majority of the subjects were female, but the sample size did not allow gender-related comparisons. In view of these various limitations plus the scarcity of pain drawing studies in TMD pain patient samples, more clinical and research studies are clearly indicated to test comorbid pain assessment methods in various clinical settings, including prospective and prognostic evaluations.

In conclusion, the results of this study have indicated that the majority of tertiary care referral patients with TMD pain report comorbid pain problems, including headaches and neckaches and other bodily comorbid pains. The localized, regional, and widespread pain profile subgroups differed in biopsychosocial adaptation, previous health care use, and self-perceived treatment needs and goals. The data support the use of drawings of whole-body pain sites as a simple adjunctive clinical and research tool to identify TMD pain patients with comorbid pains and compromised biopsychosocial profiles. Pain drawings could guide clinicians toward more comprehensive assessment and patient-specific treatment planning.

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References

1. Schiffman E, Ohrbach R, Truelove E, et al. Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for clinical and research applications: Recommendations of the International RDC/TMD Consortium Network and Orofacial Pain Special Interest Group. J Oral Facial Pain Headache 2014;28:6–27.
2. Ohrbach R, Dworkin SF. Five-year outcomes in TMD: Relationship of changes in pain to changes in physical and psychological variables. Pain 1998;74:315–326.
3. 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.
4. 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;9:613–633.
5. Dworkin SF. Psychological and psychosocial assessment. In: Laskin DM, Greene CS, Hylander WL (eds). TMDs. An Evidence-based Approach to Diagnosis and Treatment. Chicago: Quintessence, 2006:203–217.
6. Ohrbach R, List T. Predicting treatment responsiveness: Somatic and psychological factors. In: Greene CS, Laskin DM (eds). Treatment of TMDs. Bridging the Gap Between Advances in Research and Clinical Patient Management. Chicago: Quintessence, 2013:91–98.
7. Velly A, List T, Lobbezoo F. Comorbid pain and psychological conditions in patients with orofacial pain. In: Sessle BJ (ed). Orofacial Pain: Recent Advances in Assessment, Management, and Understanding of Mechanisms. Washington, DC: IASP Press, 2014:53–73.
8. Aaron LA, Burke MM, Buchwald D. Overlapping conditions among patients with chronic fatigue syndrome, fibromyalgia, and temporomandibular disorder. Arch Intern Med 2000;160:221–227.
9. Lobbezoo F, Visscher CM, Naeije M. Impaired health status, sleep disorders, and pain in the craniomandibular and cervical spinal regions. Eur J Pain 2004;8:23–30.
10. Ballegaard V, Thede-Schmidt-Hansen P, Svensson P, Jensen R. Are headache and temporomandibular disorders related? A blinded study. Cephalalgia 2008;28:832–841.
11. Plesh O, Adams SH, Gansky SA. Temporomandibular joint and muscle disorder-type pain and comorbid pains in a national US sample. J Orofac Pain 2011;25:190–198.
12. Velly A, Schweinhardt P, Fricton J. Comorbid conditions: How they affect orofacial pain. In: Greene CS, Laskin DM (eds). Treatment of TMDs. Bridging the Gap Between Advances in Research and Clinical Patient Management. Chicago: Quintessence, 2013:47–56.
13. Raphael KG, Marbach JJ. Widespread pain and the effectiveness of oral splints in myofascial face pain. J Am Dent Assoc 2001;132:305–316.
14. Velly AM, Look JO, Schiffman E, et al. The effect of fibromyalgia and widespread pain on the clinically significant temporomandibular muscle and joint pain disorders—A prospective 18-month cohort study. J Pain 2010;11:1155–1164.
15. Ohrbach R, Fillingim RB, Mulkey F, et al. Clinical findings and pain symptoms as potential risk factors for chronic TMD: Descriptive data and empirically identified domains from the OPPERA case-control study. J Pain 2011;12:T27–T45.
16. Lim PF, Smith S, Bhalang K, Slade GD, Maixner W. Development of temporomandibular disorders is associated with greater bodily pain experience. Clin J Pain 2010;26:116–120.
17. Chen H, Slade G, Lim PF, Miller V, Maixner W, Diatchenko L. Relationship between temporomandibular disorders, widespread palpation tenderness, and multiple pain conditions: A case-control study. J Pain 2012;13:1016–1027.
18. Carnes D, Ashby D, Underwood M. A systemic review of pain drawing literature: Should pain drawings be used for psychologic screening? Clin J Pain 2006;22:449–457.
19. Suvinen T, Rantala M, Ahlberg J, Könönen M. International RDC-TMD Consortium: A Designated Network of the RDC/TMD_FIN International Association for Dental Research website. www.rdc-tmdinternational.org . Accessed 4 August 2016.
20. Suvinen TI, Kemppainen P, Le Bell Y, Valjakka A, Vahlberg T, Forssell H. Research Diagnostic Criteria Axis II in screening and as a part of biopsychosocial subtyping of Finnish patients with temporomandibular disorder pain. J Orofac Pain 2013;27:314–324.
21. Türp JC, Kowalski CJ, O'Leary N, Stohler CS. Pain maps from facial pain patients indicate a broad pain geography. J Dent Res 1998;77:1465–1472.

22. Stohler CS. Management of dental occlusion. In: Laskin DM, Greene CS, Hylander WL (eds). TMDs. An Evidence-Based Approach to Diagnosis and Treatment. Chicago: Quintessence, 2006:410, Figure 27-5.
23. Dworkin SF, Huggins KH, Wilson L, et al. A randomized clinical trial using research diagnostic criteria for temporomandibular disorders-axis II to target clinic cases for a tailored self-care TMD treatment program. J Orofac Pain 2002;16:48–63.
24. Dworkin SF, Turner JA, Mancl L, et al. A randomized clinical trial of a tailored comprehensive care treatment program for temporomandibular disorders. J Orofac Pain 2002;16:259–276.
25. Von Korff M, Dunn KM. Chronic pain reconsidered. Pain 2008;138:267–276.
26. Rosenstiel AK, Keefe FJ. The use of coping strategies in chronic low back pain patients: Relationship to patient characteristics and current adjustment. Pain 1983;17:33–44.
27. Massoth DI, Dworkin SF, Whitney CW, Harrison RG, Wilson L, Turner J. Patient explanatory models for temporomandibular disorders. In: Gebhart GF, Hammond DL, Jensen TS (eds). Proceedings of the 7th World Congress on Pain. Seattle: IASP Press, 1994:187–200.
28. Forssell H, Kotiranta U, Kauko T, Suvinen T. Explanatory models of illness and treatment goals in temporomandibular disorder pain patients reporting different levels of pain-related disability. J Oral Facial Pain Headache 2016;30:14–20.
29. Melzack R. The McGill Pain Questionnaire: Major properties and scoring methods. Pain 1975;1:277–299.
30. Margolis RB, Chibnall JT, Tait RC. Test-retest reliability of the pain drawing instrument. Pain 1988;33:49–51.
31. Barbero M, Moresi F, Leoni D, Gatti R, Egloff M, Falla D. Test-retest reliability of pain extent and pain location using a novel method for pain drawing analysis. Eur J Pain 2015; 19:1129–1138.
32. Sipilä K, Zitting P, Siira P, Niinimaa A, Raustia AM. Generalized pain and pain sensitivity in community subjects with facial pain: A case-control study. J Orofac Pain 2005;19:127–132.
33. Persson AL, Garametsos S, Pedersen J. Computer-aided surface estimation of pain drawings - intra- and inter-rater reliability. J Pain Res 2011;4:135–141.
34. Dworkin SF, Von Korff M, LeResche L. Multiple pains and psychiatric disturbance. An epidemiologic investigation. Arch Gen Psychiatry 1990;47:239–244.
35. Wiesinger B, Malker H, Englund E, Wänman A. Back pain in relation to musculoskeletal disorders in the jaw-face: A matched case-control study. Pain 2007;131:311–319.
36. Marklund S, Wiesinger B, Wänman A. Reciprocal influence on the incidence of symptoms in trigeminally and spinally innervated areas. Eur J Pain 2010;14:366–371.
37. Gonçalves DA, Camparis CM, Speciali JG, Franco AL, Castanharo SM, Bigal ME. Temporomandibular disorders are differentially associated with headache diagnoses: A controlled study. Clin J Pain 2011;27:611–615.
38. Schiffman E, Ohrbach R, List T, et al. Diagnostic criteria for headache attributed to temporomandibular disorders. Cephalalgia 2012;32:683–692.
39. Svensson P. Muscle pain in the head: Overlap between temporomandibular disorders and tension-type headaches. Curr Opin Neurol 2007;20:320–325.
40. Anderson GC, John MT, Ohrbach R, et al. Influence of headache frequency on clinical signs and symptoms of TMD in subjects with temple headache and TMD pain. Pain 2011; 152:765–771.
41. Caspersen N, Hirsvang JR, Kroell L, et al. Is there a relation between tension-type headache, Temporomandibular disorders and sleep? Pain Res Treat 2013;2013:845684.
42. Headache Classification Committee of the International Headache Society (IHS). The international classification of headache disorders, 3rd edition. Cephalalgia 2013;33:629–808.
43. De Laat A, Meuleman H, Stevens A, Verbeke G. Correlation between cervical spine and temporomandibular disorders. Clin Oral Investig 1998;2:54–57.
44. Visscher CM, Lobbezoo F, de Boer W, van der Meulen M, Naeije M. Psychological distress in chronic craniomandibular and cervical spinal pain patients. Eur J Oral Sci 2001;109:165–171.
45. Dao TT, Reynolds WJ, Tenenbaum HC, et al. Comorbidity between myofascial pain of the masticatory muscles and fibromyalgia. J Orofac Pain 1997;11:232–241.
46. MacFarlane TV, Gray RJM, Kincey J, Worthington HV. Factors associated with the temporomandibular disorder, pain dysfunction syndrome (PDS): Manchester case-control study. Oral Dis 2001;7:321–330.
47. Sipilä K, Ylöstalo PV, Joukamaa M, Knuuttila ML. Comorbidity between facial pain, widespread pain, and depressive symptoms in young adults. J Orofac Pain 2006;20:24–30.
48. Pfau DB, Rolke R, Nickel R, Treede RD, Daublaender M. Somatosensory profiles in subgroups of patients with myogenic temporomandibular disorders and fibromyalgia syndrome. Pain 2009;147:72–83.
49. LeResche L, Mancl LA, Drangsholt MT, Huang G, Von Korff M. Predictors of onset of facial pain and temporomandibular disorders in early adolescence. Pain 2007;129:269–278.
50. Diatchenko L, Nackley AG, Slade GD, Fillingim RB, Maixner W. Idiopathic pain disorders—pathways of vulnerability. Pain 2006;123:226–230.
51. Chen H, Nackley A, Miller V, Diatchenko L, Maixner W. Multisystem dysregulation in painful temporomandibular disorders. J Pain 2013;14:983–996.
52. Slade GD, Smith SB, Zaykin DV, et al. Facial pain with localized and widespread manifestations: Separate pathways of vulnerability. Pain 2013;154:2335–2343.
53. John MT, Miglioretti DL, LeResche L, Von Korff M, Critchlow CW. Widespread pain as a risk factor for dysfunctional temporomandibular disorder pain. Pain 2003;102:257–263.
54. Yap AU, Chua EK, Dworkin SF, Tan HH, Tan KB. Multiple pains and psychological functioning/psychologic distress in TMD patients. Int J Prosthodont 2002;15:461–466.
55. List T, John MT, Ohrbach R, Schiffman EL, Truelove EL, Anderson GC. Influence of temple headache frequency on physical functioning and emotional functioning in subjects with temporomandibular disorder pain. J Orofac Pain 2012; 26:83–90.
56. Carleton RN, Abrams MP, Kachur SS, Asmundson GJ. A comparison of anatomical sites from a tertiary care sample: Evidence of disconnect between functional and perceived disability specific to lower back pain. Eur J Pain 2010;14:410–417.
57. Bair E, Ohrbach R, Fillingim RB, et al. Multivariable modeling of phenotypic risk factors for first-onset TMD: The OPPERA prospective cohort study. J Pain 2013;14:T102–T115.
58. Diatchenko L, Fillingim RB, Smith SB, Maixner W. The phenotypic and genetic signatures of common musculoskeletal pain conditions. Nav Rev Rheumatol 2013;9:340–350.
59. Farmer AD, Coen SJ, Kano M, et al. Psychophysiological responses to pain identify reproducible human clusters. Pain 2013;154:2266–2276.
60. Ligthart L, Gerrits MM, Boomsma DI, Penninx BW. Anxiety and depression are associated with migraine and pain in general: An investigation of interrelationships. J Pain 2013;14:363–370.
61. Visscher CM, Ligthart L, Schuller AA, et al. Comorbid disorders and sociodemographic variables in temporomandibular pain in the general Dutch population. J Oral Facial Pain Headache 2015;29:51–59.
62. Jensen MP, Karoly P. Self-report scales and procedures for assessing pain in adults. In: Turk DC, Melzack R (eds). Handbook of Pain Assessment. New York: Guilford Press, 1992:135–151.