Comparison of GCPS pain intensity/interference assessments in RDC/TMD and DC/TMD as an initial tailoring method towards TMD pain patient biopsychosocial subtyping

Running title: GCPS pain intensity/interference assessments in TMD

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Abstract

Aims: Patients with temporomandibular disorders (TMD) differ in their biopsychosocial profiles. The aim of this cross-sectional study was to compare the suitability of Graded Chronic Pain Scale pain intensity/interference assessments (GCPS 2.0 vs 1.0) for biopsychosocial subtyping of Finnish tertiary care referral patients with TMD pain.

Methods: Altogether 197 TMD pain patients participated in this study. All patients received Axis II specialist-level psychosocial questionnaires of Diagnostic Criteria of Temporomandibular Disorders (DC/TMD-FIN) and Research Diagnostic Criteria of Temporomandibular Disorders (RDC/TMD-FIN), and questionnaires of additional pain-related, biopsychosocial and treatment-related variables. Clinical examinations were performed according to DC/TMD Axis I protocol. Based on the GCPS 1.0 and 2.0, the patients were categorized into TMD subtypes 1, 2 and 3 (GCPS I&II-low; II-high and III&IV) based on their biopsychosocial profiles.

Results: The distribution of TMD pain patients into TMD subtypes was similar by GCPS 1.0 and 2.0. Over 50% of the patients were moderately (TMD subtype 2) or severely (TMD subtype 3) compromised. Patients in TMD subtype 3 experienced biopsychosocial symptoms and reported previous healthcare visits significantly more often than patients in TMD subtypes 1 and 2. Patients in TMD subtype 2 reported intermediate biopsychosocial burden compared to TMD subtypes 1 and 3.

Conclusion: TMD pain patients differ in their biopsychosocial profiles and similarly to GCPS 1.0, GCPS 2.0 is a suitable instrument for categorizing TMD tertiary care pain patients into three biopsychosocially relevant TMD subtypes. GCPS 2.0 can be regarded as a suitable initial screening tool for adjunct personalized or comprehensive multidisciplinary assessment.

Keywords: temporomandibular disorders, DC/TMD, RDC/TMD, GCPS, psychosocial

Introduction

Temporomandibular disorders (TMD) are pain and functional disorders concerning the temporomandibular joints (TMJs), the masticatory muscles and associated structures[1]. The etiology of TMD is complex and multifactorial; biopsychosocial, genetic, and environmental factors may influence the onset and persistence of TMD[2,3]. Based on the OPPERA (Orofacial Pain: Prospective Evaluation and Risk Assessment) study, a large prospective cohort study designed to discover causal determinants of TMD pain, several variables such as sociodemographic[4] and clinical orofacial characteristics[5], psychological and psychosocial factors[6], general health status[7] and health care behaviors[8] predict the development of TMD. Psychological variables, such as depression, mood, somatic symptoms, perceived stress, previous life events and negative affect, predict first-onset TMD[6,9]. Various biopsychosocial risk factors such as distress, depression, anxiety, and non-specific physical symptoms are often linked with pain related to TMD[10,11]. The association between psychological distress and increased TMD pain as well as pain-related disability has also been corroborated in previous studies[10,12], whereas somatic awareness and depression are found to be common among patients who suffer from persistent TMD pain[13]. In addition, self-perceived poor general health and sleep dysfunctions as well as comorbid pains are shown to be associated with complexity of TMD pain[14-16]. Poor coping[17] and increased pain-related worry[14,18] may also be associated with increased risk for constant and chronic pain.

Recognizing the multifactorial etiology and identifying individuals with a higher psychosocial burden aids in targeting tailored treatment for TMD patients. Previous studies have indicated that TMD pain patients vary in their biopsychosocial profiles. Bair et al.[3] identified individuals in adaptive, pain-sensitive, and global symptoms clusters based on biopsychosocial measures. Turk & Rudy[19] presented three subgroups of chronic pain patients based on Multidimensional Pain Inventory (MPI) data and they identified three pain profiles: adaptive coping, interpersonally distressed, and dysfunctional chronic pain. Dworkin et al.[10,20] and Suvinen et al.[14] have introduced biopsychosocial TMD pain subtyping in three groups based on Graded Chronic Pain Scale (GCPS) pain-related interference.

Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) were developed in 1992 in order to understand the multifactorial nature of TMD. RDC/TMD is a dual-axis system, in which Axis I assigns physical diagnoses and Axis II indicates psychosocial variables of TMD, such as depression and non-specific physical symptoms[21]. An integral part of the RDC/TMD Axis II is the Graded Chronic Pain Scale 1.0 (GCPS 1.0), which consists of two main subscales, Characteristic Pain Intensity (CPI) and pain-related interference (including disability days due to pain and pain interference on daily, work, and social activities). Many studies have demonstrated that RDC/TMD are valid criteria for assessing pain grade and pain-related psychosocial dysfunction[12,14,22-27].

Based on the GCPS assessment, patients are categorized into five levels of pain-related impairment as follows: grade 0, no pain or disability; grade I, low intensity and no or low disability; grade II, high intensity and no or low disability; grade III, moderately limiting disability; and grade IV, severely limiting disability[10,20,23]. Grade II has further been divided into two grades (grade II-high and grade II-low), which share the same pain intensity but vary in disability[10,20]. Previous studies have reported that patients in GCPS grades 0, I and II-low are considered 'psychosocially functional', whereas patients with intense pain and moderate to severe disability (GCPS grades II-high, III and IV) are considered 'psychosocially dysfunctional'[10,20,21]. Psychosocially dysfunctional TMD patients have reported higher levels of psychosocial loading factors, such as depression, non-specific physical or somatic symptoms, as well as sleep dysfunction, pain-related worry, poor coping ability, poor self-perceived general health, catastrophizing thoughts, and chronic pain[10,14,20,27]. GCPS 1.0 (RDC/TMD) has been suggested as a useful instrument to classify TMD patients into clinically relevant psychosocial subtypes in primary care[28] and into biopsychosocial subtypes in tertiary care[14].

Diagnostic Criteria of Temporomandibular disorders (DC/TMD), a revised, evidence-based and diagnostically more reliable version of RDC/TMD, was introduced in 2014[29]. Whereas the RDC/TMD criteria were mainly intended for research settings, the DC/TMD criteria are better suited for implementation in clinical settings as well. Furthermore, the DC/TMD criteria include new instruments to assess pain behavior, psychological status, and psychosocial functioning[29]. DC/TMD Axis II includes instruments for screening and for comprehensive specialist level assessments: Patient Health Questionnaire-4 (PHQ-4) for

screening of psychological distress, and for more comprehensive assessment of depression symptoms (PHQ-9), anxiety symptoms (Generalized Anxiety Disorder-7, GAD-7) and non-specific physical symptoms (PHQ-15)[29]. Moreover, the DC/TMD criteria include an updated GCPS questionnaire, GCPS 2.0. It evaluates pain-related intensity and interference during a 30-day timeframe compared to the 6-month timeframe in the previous RDC/TMD GCPS 1.0 version.

A recent study using GCPS 2.0 reported that among the psychological and socio-demographic factors, somatization was the best predictor of pain intensity, while pain-related disability was best predicted by depression[30]. The discriminative properties of GCPS 2.0 towards biopsychosocial profiling and in relation to GCPS 1.0 (RDC/TMD) have, however, not been previously investigated.

The aim of this cross-sectional study was to compare the Finnish versions of DC/TMD and RDC/TMD Axis II specialist-level psychosocial assessments, and especially, to compare the suitability of GCPS pain intensity/interference assessments (GCPS 1.0 and 2.0) in biopsychosocial subtyping of Finnish tertiary care referral TMD pain patients. A further aim was to assess the suitability of GCPS 2.0 (in comparison with GCPS 1.0) as an initial screening tool for adjunct personalized or comprehensive multidisciplinary treatment. For this purpose, the associations between Axis II GCPS 2.0 and 1.0 and Axis II specialist-level psychological assessments as well as additional pain-related, biopsychosocial, and treatment-related variables, were analyzed. The working hypotheses were firstly, that GCPS 2.0 is similar to GCPS 1.0 as an initial tailoring method in biopsychosocial subtyping of TMD pain patients and secondly, that GCPS 2.0 can be used as a screening tool in early identification of TMD patients with moderately or severely compromised biopsychosocial adaptation.

Materials and Methods

Altogether 197 TMD pain patients (158 females, 39 males, mean age 43.3 years, range 17 to 83 years), referred for assessment and TMD treatment planning in tertiary care of the Oral and Maxillofacial Diseases Departments of Helsinki University Hospital, Kuopio University

Hospital, Oulu University Hospital, and Turku University Hospital between July 2015 and March 2019, participated in this study. All patients 17 years or older who had clinically diagnosed TMD were included in the study. The sample size was set according to the guidelines of the INfORM consortium[31]

Participation in the study was voluntary and the subjects provided informed consent. The Ethics Committee of the Hospital District of Southwest Finland has approved the study (74/1082/2015).

Axis I somatic diagnostics

The clinical TMD examinations and all the questionnaire evaluations were performed by four examiners (authors PK, RN, KS and TTO) according to the Finnish version of DC/TMD[29,31]. The examiners had been trained prior to this study by the Malmö International DC/TMD Training and Calibration Center and calibrated against a reference standard examiner in Finnish language[32] according to the INfORM Consortium guidelines[31].

Clinical Axis I diagnostics was based on the Symptom Questionnaire, the DC/TMD standardized clinical examination protocol and Axis I decision trees[32]. The diagnoses included TMD pain-related diagnoses (myalgia, myofascial pain, arthralgia, TMD-related headache) and joint-related diagnoses. Multiple diagnoses were allowed.

Axis II questionnaires and additional biopsychosocial assessments

All patients received Finnish versions of both RDC/TMD and DC/TMD Axis II specialist-level psychosocial questionnaires and questionnaires of additional pain-related, biopsychosocial, and treatment-related questions to be filled in at home. The questionnaires were assessed for accuracy with the treating clinicians at the time of clinical examination. Prior to this study, the Axis II instruments had undergone a comprehensive translation process by the International INfORM Consortium according to the Guidelines for Establishing Cultural Equivalency of Instruments[31].

1. RDC/TMD-FIN Axis II questionnaires

The RDC/TMD-FIN Axis II questionnaires included the assessment of TMD pain intensity/interference using GCPS 1.0 and the assessment of the level of depression symptoms and non-specific physical symptom with and without pain items using SCL-90-R (RDC/TMD-FIN[34]). The RDC/TMD-FIN GCPS 1.0-questionnaire assessed patient-based reports of TMD pain intensity and pain-related interference in three domains during the past 6 months as follows:

a) CPI (characteristic pain intensity) (current, worst, average) (range 0–10, 0 = no pain, 10 = worst pain) (scaled as mean value*10, maximum 100);

b) disability days (range 0–180 days; 0–3 points), categorized as 0–6 days = 0 disability days points; 7–14 days = 1 disability days point; 15–30 days = 2 disability days points; 31+ days = 3 disability days points), and

c) disability/interference score (range 0–100; 0–3 points) by pain interference with daily, social and work-related activities (range 0–10, 0 = no interference, 10 = unable to carry on any activities) (scaled as mean value*10, maximum 100) (Score of 0–29 = 0 Disability Points; Score of 30–49 = 1 pain-related activity interference point; Score of 50–69 = 2 points, score of 70+ = 3 points)

The total count of pain interference/disability points (range 0–6 points) towards GCPS 1.0 grading (including CPI) is based on the sum of points for disability days + points for disability score (see section GCPS grades).

With the RDC/TMD-FIN Axis II SCL-90-R questionnaires, patients reported how much they had suffered during the last month from (range 0–4, 0 = not at all, 4 = very much) symptoms of depression (20 questions), non-specific physical symptoms including pain items (12 questions) or without pain items (7 questions)[21].

2. DC/TMD-FIN Axis II questionnaires

The DC/TMD-FIN questionnaires included the sociodemographic background data. For the analysis, marital status was dichotomized as married/cohabiting vs. single (divorced, separated, widowed, or never married). Level of education was dichotomized as lower (basic

education/high school/vocational school) vs. higher (university of applied sciences/university/Master of Arts). Working status was dichotomized as employed (working outside home/at home) vs. unemployed (unemployed/student/retired/on disability/retired due to sickness/sick leave/in rehabilitation).

The DC/TMD-FIN Axis II questionnaires included the TMD pain intensity/interference assessment using GCPS 2.0, symptoms of depression (PHQ-9), anxiety (GAD-7) and physical symptoms (PHQ-15) (DC/TMD-FIN)[32].

The DC/TMD GCPS 2.0 questionnaire assessed patient-based reports of TMD pain intensity and pain-related interference based on four domains (three domains (b, c and d) assessed during the past 30 days) measured by the questions:

a) pain days during the past 6 months (range 0–180 days)

b) CPI (characteristic pain intensity (current, worst, average) (range 0–10, 0 = no pain, 10 = worst pain) (CPI, mean value*10, maximum 100);

c) disability days (range 0–30 days; 0–3 points), scored as: 1 day = score 1; 2–7 days = scores 2–7, respectively; 8–20 days = score 8, 21–25 days = score 9; 26–30 days = score 10. Disability days points were categorized as follows: 0–1 days (score 1) = 0 disability days points; 2 days (score 2) = 1 disability days point; 3–5 days (score 3–5) = 2 disability days points; 6+ days (score 6+) = 3 disability days points.

d) disability/interference score (range 0–100; 0–3 points) by pain interference with daily, social, and work-related activities (range 0–10, 0 = no interference, 10 = unable to carry on any activities), scaled to mean value*10, maximum 100, and categorized as: 0–29 = 0 pain-related activity interference points; 30–49 = 1 point; 50–69 = 2 points, 70 and over = 3 points).

The total count of pain interference/disability points (range 0–6) towards GCPS 2.0 grading (including CPI) is based on the sum of points for disability days + points for pain-related activity interference (see section GCPS grades).

With the DC/TMD-FIN Axis II questionnaires the patients reported how much they suffered from various symptoms of

a) depression (PHQ-9-FIN, 9 questions, range 0–3, where 0 is 'not at all' and 3 'nearly every day') during the past 2 weeks.

b) anxiety (GAD-7-FIN, 7 questions, range 0–3, where 0 is 'not at all' and 3 'nearly every day') during the last 2 weeks).

c) physical symptoms (PHQ-15-FIN, 15 questions, range 0–2, where 0 is 'not bothered' and 2 'bothered a lot during the past 4 weeks').

Potential bias may be linked with the missing data. In the sum scores of depression, anxiety and physical symptoms, missing values were replaced with the mean value of other items. If there were missing values for more items than the following limits, the response was considered as missing for the instrument: GCPS 1.0 and GCPS 2.0; CPI: 0 items (n=4 for CPI/GCPS 1.0 and n=5 for CPI/GCPS 2.0), pain-related activity interference: 1 item (n=5 for both GCPS 1.0 and GCPS 2.0), RDC/TMD depression: 8 items (n=9), somatization with pain: 4 items (n=8), somatization without pain: 2 items (n=8), PHQ-9: 3 items (n=4), PHQ-15: 5 items (n=4), GAD-7: 2 items (n=6)[21,35] .

3. Additional pain-related, biopsychosocial and treatment related variables

Additional pain-related, biopsychosocial and treatment related variables were inquired in DC/TMD Symptom Questionnaire and additional questionnaire as follows:

-Pain duration: "How many years or months ago did your pain in the jaw, temple, in the ear, or in front of the ear first begin?" (DC/TMD-FIN[32])

-Pain frequency: 'In the last 30 days, which of the following best describes any pain in your jaw, temple, in the ear, or in front of the ear on either side: No pain, Pain comes and goes (recurrent pain), Pain is always present' (constant pain) (DC/TMD-FIN[32])

-Comorbid pains: Patients reported whether they suffered from any of the following comorbid pain problems: headache, neck ache, back pain, stomach pain, fibromyalgia pain, joint pain, other pain (chest pain, pain in the arms/legs of any other pain) (1 = yes, 0 = no)[36]

-Patient-perceived general health status: 'In general, how would you rate your overall health?' (with options excellent, very good, good, fair or poor, 1 = excellent, 5 = poor)
-Anxiety: 'How anxious have you felt during the last week?', range 0–10, where 0 is 'absolutely calm' and 10 is 'as anxious as I've ever felt'[37]
-Stress: 'How nervous or stressed have you felt during the last week?', range 0–10, where 0 is 'no stress' and 10 'I felt myself very stressed'[37]
-Patients' level of worry about their pain condition: 'How worried are you about the pain and symptoms?', range 0–10, where 0 is 'not worried at all' and 10 is 'extremely worried'?"[18]
-Sleep dysfunction was assessed by the average score of 3 questions of the SCL-90R measuring sleep disturbance (difficulty falling asleep, restless sleep and early morning awakening), range 0–4, where 0 is 'no difficulty' and 4 is 'a lot of difficulty'[38]
-Coping questions were derived from the Coping Strategies Questionnaire, measuring 1) ability to control pain (range 0–6, where 0 is 'no control' and 6 is 'under control') or 2) the ability to decrease pain (range 0–6, where 0 is 'no ability to decrease' and 6 is 'ability to decrease')[39]
-Previous healthcare visits and current subjective treatment expectations: Patients were also asked to indicate the number of previous visits to dentists/doctors or other healthcare professionals and their current self-perceived goals and treatment expectations regarding the need to receive information, improvement of pain control, jaw function and/or stress management skills or their performance in daily and/or work ability (0 = no, 1 = yes).

4. GCPS grades and TMD pain patient subtyping

According to the GCPS 1.0 and 2.0, the grades were determined as follows according to Dworkin and LeResche[21] and Orhbach and Knibbe[35]:

GCPS grade I: low intensity pain (CPI < 50) and without or with low disability (0–2 disability points)

GCPS grade II: high intensity pain (CPI ≥ 50) and without or with low disability (0–2 disability points). Patients in GCPS grade II were further subdivided into two grades according to Dworkin et al. (2002ab): GCPS grade II-Low: no disability (disability points = 0); GCPS grade II-High = low disability (disability points = 1–2).

GCPS grade III: 3–4 disability points regardless of CPI value (determined as moderately limiting)

GCPS grade IV: 5–6 disability points regardless of CPI value (determined as severely limiting).

The biopsychosocial TMD pain subtyping assessments were analyzed in the three TMD subtypes 1, 2 and 3 based on the GCPS1.0 and GCPS 2.0 grades according to Dworkin et al.[10,20] and Suvinen et al.[14] as follows:

(i) TMD subtype 1 = GCPS grades I (CPI < 50, 0–2 disability points) and II-Low (CPI ≥ 50, 0 disability points),

(ii) TMD subtype 2= GCPS grade II-High (CPI ≥ 50, 1–2 disability points), and

(iii) TMD subtype 3= GCPS grades III (3–4 disability points) and GCPS grade IV (5–6 disability points).

Statistical Analysis

The differences in sociodemographic background, Axis I diagnoses, pain frequency, and comorbid pain sites between TMD subtypes of GCPS1.0 and GCPS2.0 were analyzed using chi-square tests. The differences in self-perceived goals and treatment expectations between TMD subtypes of GCPS1.0 and GCPS2.0 were analyzed using Likelihood ratio test.

In Axis II questionnaire assessments (SCL-90R, PHQ-9, PHQ-15, GAD-7) raw mean and median of the sum scores were calculated, and box plots generated to include the interquartile ranges (25^{th} and 75^{th} percentiles) as well as the minimum and maximum scores.

The differences in continuous variables (sum scores of depression, anxiety and non-specific physical symptoms/somatization, number of Axis I diagnoses, pain duration, number of comorbid pain sites, number of visits to dentist/doctor, and additional psychosocial variables) between TMD subtypes of GCPS1.0 and GCPS2.0 were analyzed using Jonckheere-Terpstra tests. The statistical significance was set at $p < 0.05$. In pairwise comparisons of these variables (differences between TMD subtype 3 vs. 1 and 2; and TMD subtype 2 vs. 1 and 3) Mann-Whitney U test was used. After Bonferroni correction, the statistical

significance was set at $p < 0.017$. Data were analyzed using SPSS for Windows version 25 (SPPS Inc., Chicago, Ill., USA).

Results

There were no significant differences in the sociodemographic background (gender, mean age, marital status, and education level) between the TMD subtypes (based on GCPS1.0 or GCPS2.0). The majority of the patients were married (61.9%), 41.1% had received higher education, and 49.7% were employed.

GCPS 1.0 and 2.0 Assessment data in TMD subtypes

The distribution into GCPS scoring items and GCPS grades as well as classification into GCPS grades/TMD subtypes was similar among TMD pain patients as assessed with both GCPS 1.0 and 2.0 (Table 1). A majority of the patients belonged to either TMD subtype 1 (42.3%) or TMD subtype 3 (38.3%) using GCPS 1.0. Similarly, based on GCPS 2.0, the majority of the patients belonged to TMD subtype 1 (46.7%) and TMD subtype 3 (41.3%). More patients were classified into TMD subtype 2 (Grade II-high) based on GCPS 1.0 in comparison with GCPS 2.0. Over 50% of the patients were considered as moderately (TMD subtype 2) or severely (TMD subtype 3) compromised (57.7% by GCPS 1.0 and 53.3% by GCPS 2.0).

Axis I diagnoses in TMD subtypes

The distribution of the DC/TMD Axis I diagnoses according to the TMD subtypes is presented in Tables 2a and 2b. Most patients had multiple Axis I pain-related diagnoses. In the total sample, myalgia and arthralgia diagnoses were the most prevalent Axis I diagnoses. No TMJ subluxations were diagnosed. The total number of diagnoses and the number of pain-related diagnoses differed significantly between TMD subtypes, whereas no significant differences were found in the number of joint-related diagnoses. Pain-related diagnoses were more prevalent in TMD subtypes 2 and 3 than in TMD subtype 1.

In pairwise comparisons, the total number of Axis I diagnoses differed significantly between TMD subtypes 1 vs. 2 ($p = 0.006$) and 1 vs. 3 ($p < 0.001$) in GCPS 1.0. In GCPS 2.0, the difference between TMD subtypes 1 vs. 3 ($p < 0.001$) was statistically significant. The number of pain-related diagnoses differed significantly between TMD subtypes 1 vs. 2 ($p = 0.003$) and 1 vs. 3 ($p < 0.001$) according to GCPS 1.0, and between TMD subtypes 1 vs. 3 according to GCPS 2.0 ($p < 0.001$).

Axis II variables in TMD subtypes

The sum scores of depression and non-specific physical symptoms (with pain items and without pain items) assessed using SCL-90R were the highest among those in TMD subtype 3 based on GCPS1.0 (Fig. 1). The differences between TMD subtypes were statistically significant ($p < .001$, Jonckheere-Terpstra). In pairwise comparisons, TMD subtype 3 differed statistically significantly from TMD subtypes 1 and 2 in all measured items.

Based on GCPS 2.0, the sum scores of depression (PHQ-9), physical symptoms (PHQ-15) and anxiety (GAD-7) were the highest among those in TMD subtype 3 (Fig 2). The differences between TMD subtypes were statistically significant ($p < 0.001$, Jonckheere-Terpstra test). In pairwise comparisons, TMD subtype 3 differed statistically significantly from TMD subtypes 1 and 2 in all measured items ($p < 0.001$, Mann-Whitney U test).

Additional Pain data in TMD subtypes

The mean pain duration differed significantly between TMD subtypes (Table 3). In pairwise comparisons, statistical difference was found in pain duration between TMD subtypes 1 and 3 of GCPS 2.0 ($p = 0.014$). The responses of pain frequency were similarly distributed between TMD subtypes of GCPS 1.0 and GCPS 2.0, constant pain being reported most frequently in TMD subtype 3 (Table 3).

The most prevalent self-reported comorbid pains were headache and neck pain (Table 3). The number of different comorbid pains tended to be the highest in TMD subtype 3. The mean number of pain sites differed significantly between TMD subtypes ($p < 0.001$) (Table 3).

Additional biopsychosocial variables in TMD subtypes

Additional biopsychosocial variables are presented in Table 4. Significant differences between TMD subtypes were noted in all measured additional biopsychosocial variables (items) based on both GCPS 1.0 and GCPS2.0. In pairwise comparisons, the difference between TMD subtypes 1 and 2 was statistically significant in item 'worry' ($p = 0.003$) according to GCPS 2.0. Between TMD subtypes 2 and 3, there was statistically significant difference in items 'worry' ($p = 0.004$), 'control' ($p = 0.004$), 'anxiety' ($p = 0.001$)' and 'sleep dysfunction' ($p < 0.001$) according to GCPS 1.0, and only in 'sleep dysfunction' ($p < 0.001$) according to GCPS 2.0. The differences between TMD subtypes 1 and 3 were statistically significant concerning all items ($p < 0.001$).

Treatment-related variables in TMD subtypes

The number of previous healthcare visits and patients' self-perceived treatment expectations are presented in Table 5. Patients in TMD subtype 3 reported the highest number of previous visits to dentist/doctor or other healthcare professionals according to GCPS 1.0 and GCPS 2.0. In pairwise comparisons, significant differences were noted in the number of previous healthcare visits when comparing TMD subtypes 1 and 3 using GCPS 1.0 and GCPS 2.0 ($p < 0.001$). TMD subtypes 2 and 3 also differed significantly in the number of previous healthcare visits according to GCPS 1.0 ($p < 0.001$), but only in "visits to other healthcare professionals", when using GCPS 2.0 ($p = 0.008$).

Almost all TMD pain patients in this study reported the need to receive information as well as an improvement of pain control and jaw function as their treatment expectations. About half of the patients reported the need to improve their stress control. More patients in TMD subtypes 2 and 3 in comparison to those in TMD subtype 1 also reported a need to improve their performance in daily and/or work activities.

Discussion

The present study evaluated the suitability of DC/TMD (GCPS 2.0) in comparison with RDC/TMD (GCPS 1.0) in categorizing TMD referral pain patients into three TMD subtypes with different biopsychosocial profiles. The TMD pain patient groups in these three TMD subtypes differed significantly in the levels of depression, anxiety and non-specific physical symptoms and clinical diagnoses. Furthermore, pain variables and comorbid pains as well as additional biopsychosocial risk factors and treatment related variables differed significantly between these three TMD subtypes, with symptom severity increasing towards subtype 3.

The results showed that both GCPS 1.0 and GCPS 2.0 distinguished three TMD subtypes similarly. Therefore, GCPS 2.0 can also be considered applicable for categorizing TMD pain patients in biopsychosocially relevant subtypes similar to GCPS 1.0 presented in the previous studies of Dworkin et al.[10,20] and Suvinen et al.[14]. These results thus support the working hypotheses. As the present study is among the first ones to investigate the comparison of GCPS 1.0 and GCPS 2.0 in the same study population, there is currently little previous data on the subject. For both GCPS 1.0 and 2.0, the differences between TMD pain patients in TMD subtypes 1 and 3 were statistically significant in Axis I clinical diagnoses, additional biopsychosocial and treatment-related variables, whereas the differences between TMD subtypes 2 and 3 were more clearly seen based on GCPS 1.0 than on GCPS 2.0. The different results between GCPS 1.0 and GCPS 2.0 might be due to the different timeframes used (6 months vs. 30 days, respectively) in GCPS determination. It is noteworthy that a shorter 1-month time frame (GCPS 2.0) may be more useful in screening more current or on-going pain impact, similar to other DC/TMD instruments, whilst a 6-month time frame (GCPS 1.0) may be more useful for the assessment of pain impact over a longer time period, especially in the compromised TMD subtypes or chronic TMD. This has also been supported in the DC/TMD instrument scoring manual that includes both versions of GCPS instruments[35].

Overall, by both versions, over 50% of the TMD pain patients in this study presented with either severely (TMD subtype 3) or moderately compromised (TMD subtype 2) biopsychosocial profiles, thus supporting the second hypothesis, i.e. that GCPS 2.0 can be used as an initial screening tool towards the early identification of TMD patients with moderately or severely compromised biopsychosocial adaptation. A minor difference was found in the prevalence of patients in TMD subtype 2 based on GCPS 1.0 categorizing more patients in this subtype than GCPS 2.0 did. A previous study of Suvinen et al.[14] on tertiary

care patients in Finland showed higher prevalence of patients in TMD subtype 2 (33.3%), but lower prevalence in TMD subtype 3 (22.9%) compared with the present study (19.4% and 38.3% based on GCPS 1.0, respectively). Other previous GCPS 1.0 studies have reported varying prevalences in different study populations. In a previous study by Dworkin et al.[10], a total of 117 usual treatment (n=58) and comprehensive care (n=59) TMD pain patients with disability were distributed into GCPS grades as follows: II-high (30.8 %), III (27.3 %), and IV (41.9%). Others have reported lower prevalences; e.g. a study by De La Torre Canales et al.[40] on 691 Italian tertiary care TMD patients reported that only a small proportion (4.3%) of the patients showed severely limiting, high disability pain-related impairment (GCPS grade IV) while the majority presented no or low disability (GCPS grades I and II). Similarly, in a multicenter study by Manfredini et al.[12], a total of 16.9% of tertiary care TMD patients showed severely limiting disability (GCPS grades III and IV). Compared to these previous studies, the higher percentages concerning TMD subtypes 2 and 3 reported in the present study might also be due to the differences between the selection of study populations and variations in the paths of referral in different countries as well as cultural differences. In fact, the work of Manfredini and coworkers[12] found distinct differences between different nationalities in pain-related disability reports.

In addition to the patient division into TMD subtypes based on GCPS grades, several other categorizations of TMD pain patients based on biopsychosocial profiles have been reported. Bair et al.[3] presented a division of TMD pain patients and TMD-free controls into three clusters based on a large array of biopsychosocial measures. They found that almost all (91.5%) of the subjects with TMD belonged to the pain-sensitive and global symptoms clusters, whereas the adaptive cluster included 8.5% of the TMD-subjects and 41.2% of non-TMD subjects. Compared with the adaptive cluster, the pain-sensitive cluster participants showed heightened sensitivity to experimental pain, and those in the global symptoms cluster showed both greater pain sensitivity and greater psychological distress. In addition, compared to subjects without TMD, the TMD subjects in the pain-sensitive and global symptoms clusters also showed higher pain intensity, jaw functional limitation, and more comorbid pains[3]. In the present study, more psychological distress (symptoms of depression and anxiety) and more comorbid pains were also found most often in the compromised TMD subtypes 2 and 3 similar to the pain-sensitive and global symptoms clusters[3]. In addition, the

TMD subtypes presented in this study are also comparable to the adaptive coping, interpersonally distressed, and dysfunctional chronic pain profiles of patients (based on Multidimensional Pain Inventory, MPI data) by Turk & Rudy[19]. In dysfunctional chronic pain profile, the patients reported more severe pain and more remarkable interference of pain in their lives than in other profiles, which is similar to patients in TMD subtype 3 with more disability days and more pain interference with daily, social and work-related activities than TMD pain patients in TMD subtypes 1 and 2. Patients in the adaptive coping profile and in TMD subtype 1 seemed to be similar, reflecting lower impact of their pain problems and appearing to cope better with their conditions than patients in TMD subtypes 3, whilst subtype 2 formed an intermediate subtype.

Multiple pain-related clinical diagnoses were discovered in all patients regardless of TMD subtypes. For myalgia and arthralgia diagnoses, the distributions were quite similar in TMD subtypes 2 and 3, whereas for the other pain-related diagnoses, TMD subtype 2 formed an intermediate subtype between TMD subtypes 1 and 3. The mean number of all diagnoses as well as pain-related diagnoses was significantly higher in TMD subtype 3 (based on GCPS 2.0) and in TMD subtypes 2 and 3 (based on GCPS 1.0) in comparison with TMD subtype 1. Therefore, the study findings confirm the importance of pain-related diagnostics as implemented in the new DC/TMD criteria. The joint-related diagnoses did not differ between TMD subtypes. It has been stated that muscle-related diagnoses are more often associated with psychosocial factors than joint-related diagnoses[41], which are usually more "anatomically originated" and linked with structural disturbances of the TMJ, such as loose ligaments or disc problems, rather than pain chronicity.

The sum scores of depression and non-specific physical symptoms, as assessed by both RDC/TMD and DC/TMD Axis II instruments, were higher in TMD subtypes 2 and 3 compared to TMD subtype 1. In addition, the highest values of anxiety symptoms, based on GAD-7, were similarly shown in these TMD subtypes. These results, based on both RDC/TMD and DC/TMD, are in line with previous studies investigating the association between depression/somatization symptoms and pain-related disability using the RDC/TMD Axis II instruments[10,12,14,26,27,42].

Various biopsychosocial assessment variables as risk factors related to TMD pain onset or chronicity have been presented in the biopsychosocial models of pain and in studies

concerning TMD pain patients as well as in OPPERA studies[3,11,14,17,19]. These risk factors include general health status, health care behaviors as well as psychological variables such as depression, mood, somatic symptoms, perceived stress, previous life events and negative affect[6-9,] . Of the variables that are not included in RDC/TMD or DC/TMD, self-perceived general health status, stress, pain-related worry, sleep dysfunction, and ability to control pain (coping) have shown association with chronic TMD pain or pain continuity[14-17]. In the present study, besides DC/TMD and RDC/TMD Axis II variables, additional pain-related, biopsychosocial and treatment related variables were included in the profiling of the TMD patients as shown in previous studies[14,18,37,39]. Adding these additional biopsychosocial assessment variables in the present study further emphasized the results of TMD pain patient categorization into the three biopsychosocial subtypes. Significant differences between the TMD subtypes were noted in all measured additional biopsychosocial variables (general health status, stress, pain-related worry, sleep dysfunction, and ability to control pain, coping ability) based on both GCPS 1.0 and GCPS2.0. The differences were most remarkable between TMD subtypes 1 and 3 in all of these variables. In addition, the GCPS 1.0 version, with a longer assessment period of 6 months, was also more sensitive to distinguish between TMD subtypes 2 and 3 (in items 'worry', 'control', 'anxiety' and 'sleep dysfunction'), whilst with GCPS 2.0 1-month version, only sleep dysfunction differed significantly between these TMD subtypes. These results indicate that the burden linked with these additional biopsychosocial risk factors accumulated most in TMD subtypes 2 and 3, which creates a need for considering their assessment as part of individualized treatment planning of TMD pain patients. As part of comprehensive care, assessment of sleep problems among others risk factors should be included in the most disabled or TMD subtype 3 patients.

In addition to the risk factors, it is noteworthy that patients in this study reported multiple comorbid pain problems, such as headache, neck pain and fibromyalgia, as they reported on average at least 4 body pain sites. Earlier studies have also shown the association of TMD with comorbid pains and fibromyalgia[36,43,44]. Comorbid pains have also been shown to predict clinical TMD[44] and increase the risk for poor prognosis of TMD pain treatment[46]. In the present study, several comorbid pain sites were reported in all TMD subtypes. Headache, stomachache, fibromyalgia pain as well as the number of comorbid pain sites

differed statistically significantly between the TMD subtypes, which is in line with the previous study by Suvinen et al.[36]. Furthermore, in the present study, TMD subtype 3 showed a similar profile compared to the global symptoms cluster in the study by Bair et al.[3], which had most severe symptoms related to clinical pain and more comorbid pains.

It is of clinical relevance and noteworthy in this study that the most severely compromised patients (TMD subtype 3) reported the most severe biopsychosocial burden. In addition, patients in TMD subtype 2 with intense pain and low disability formed an intermediate subgroup between the uncompromised TMD subtype 1 and the most vulnerable TMD subtype 3 TMD pain patients. This TMD subtype 2 was characterized by clinical findings comparable to TMD subtype 3, but reported intermediate biopsychosocial burden compared to TMD subtypes 1 and 3, similar to the study by Suvinen et al. (2013). This is also in line with the study by Bair et al. (2016), which reported modest but greater psychological distress in the pain sensitive cluster compared with the adaptive cluster. Special attention should be paid to the patients in TMD subtype 3 as well as in the intermediate TMD subtype 2 since they may be at potential risk of their symptoms becoming chronic[10,14,20,47,48].

The dual-axis approach of DC/TMD criteria addressed the need towards identifying not only clinical diagnostics, but also other measures related to other biopsychosocial risk factors and overall psychosocial impact of TMD pain. Multi-axial classifications, such as the triaxial or subtyping approaches presented here or by Turk and Rudy[19] and Blair et al.[3] can help to identify patients with compromised TMD pain profiles and to plan tailored personalized and/or multiaxial treatment approaches suitable for the identified patient subtypes. GCPS grading has previously been used for planning tailored treatment[10,20]. The randomized controlled studies by Dworkin et al.[10,20] evaluated the effect of usual conservative treatment of TMD for TMD patients with no disability (TMD subtype 1) and conservative TMD treatment with 6-session CBT for TMD patients with low (TMD subtype 2) or moderately or severely limiting disability (TMD subtype 3)[10,20]. The patients in TMD subtype 1 benefitted from a self-care program[20], whereas more comprehensive treatment was more effective for patients with higher pain-related disability[10].

In the present study, all patients, irrespective of the TMD subtype, reported a long history of pain duration (on average 6–7 years) before referral to tertiary care. The use of healthcare services (dentist/doctor or other) increased along with the increasing pain intensity/interference as the number of visits to either dentist or doctor was 2–3 times higher, and the number of visits to other healthcare services roughly 4–6 times higher among patients in TMD subtype 3 than in TMD subtypes 2 and 1. Early recognition and tailored treatment of the patients in different TMD subtypes, and especially those with compromised biopsychosocial profiles in subtypes 2 and 3 at risk for chronic TMD, might decrease the number of visits to dentists, doctors or other healthcare professionals, taking also into account the cost-effectiveness of the TMD treatment[49]. In addition, those with higher pain-related disability/interference indicated the highest need for improved daily performance, especially work ability, which is in accordance with the study performed in patients in primary care[50]. Regardless of the TMD subtype, almost all patients expected to receive more information, improved pain control and jaw function from the treatment. This might be due to the fact that the patients had not previously received enough information about their pain problems or that the treatment received earlier had not worked for them. Therefore, it is important that appropriate information and counseling is given and emphasized at the very early stages of TMD treatment[10,20,51].

The size of the study population can be considered as one of the strengths of the present research, together with the use of comparative RDC/TMD and DC/TMD criteria assessments in the same patient population. Furthermore, the clinical examinations and questionnaires were based on internationally valid instruments and all examiners were trained in the use of DC/TMD criteria as well as calibrated and reliability-trained for DC/TMD Axis I clinical examination. It should be noted that the Axis II instruments used in the present study are mainly intended for screening and assessing the level and impact of psychosocial factors as a part of comprehensive specialist level assessment, not for diagnosis. To avoid potential intercultural variation, in Axis II questionnaire assessments (SCL-90R, PHQ-9, PHQ-15, GAD-7) raw mean and median scores were calculated and compared, and no subclassifications were performed. The limitation of the study may be that the patient material was TMD pain patients referred for specialist care and the results may thus not be comparable to primary care. Potential bias may be linked to missing data, however, their proportions were

considered to be relatively low (highest for RDC/TMD depression, 4.5%). In addition, the patient population did not allow comparison between females and males, and the cross-sectional nature of the study at this point does not allow longitudinal data concerning the patients, thus creating a need for follow-up studies. Research is also needed to evaluate the effect of tailored treatment based on the categorization of TMD pain patients into TMD subtypes. Further research is also needed especially regarding patients in TMD subtypes 2 and 3 to investigate their profiles more intensively in tailored treatment programs and longitudinally.

Conclusion

In conclusion, TMD pain patients differ in their biopsychosocial profiles and similar to GCPS 1.0, GCPS 2.0 is a suitable initial instrument for distributing TMD tertiary care pain patients into three biopsychosocially relevant TMD subtypes. Biopsychosocial symptoms such as depression and anxiety symptoms, non-specific physical or somatic symptoms, comorbid pains and other biopsychosocial burden (impaired general health, worry, lack of pain control/coping, stress, sleep dysfunction) are more prevalent among patients in TMD subtype 3 than among those in TMD subtypes 1 and 2. TMD subtype 2 forms an intermediate group with regard to biopsychosocial symptoms. GCPS 2.0, similar to GCPS 1.0, can be regarded as a suitable initial screening tool towards adjunct personalized or comprehensive multidisciplinary assessment.

Key findings

- GCPS 2.0, similar to GCPS 1.0, is a useful initial screening instrument in the biopsychosocial subtyping of TMD pain patients for personalized treatment planning.
- The prevalence of several biopsychosocial symptoms is highest among patients in TMD subtype 3, whereas TMD subtype 2 forms an intermediate group between TMD subtypes 1 and 3.

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Table 1. Distribution of GCPS 1.0 and 2.0 scoring items (CPI, DP), GCPS grades and TMD subtypes (Dworkin et al.[10,20] and Suvinen et al.[14]) in the study sample of 197 TMD pain patients.

		GCPS 1.0 (n=180)		GCPS 2.0 (n=184)	
		n	**%**	**n**	**%**
CPI	1–50	55	28.6	74	38.8
	≥ 50	137	71.4	115	60.2
Disability points (DP) (0-6)					
	0	74	40.9	81	43.6
	1-2	38	21.0	29	15.6
	3-4	28	15.5	31	16.6
	5-6	41	22.6	45	24.2
GCPS Grades					
	I	48	26.7	61	33.1
	II low	28	15.6	25	13.6
	II high	35	19.4	22	12.0
	III	28	15.6	31	16.8
	IV	41	22.7	45	24.5
TMD subtypes					
	1 (I+II-low)	76	42.3	86	46.7
	2 (II-high)	35	19.4	22	12.0
	3 (III+IV)	69	38.3	76	41.3

Table 2a. (Mean number and standard deviation (SD) of DC/TMD Axis I diagnoses in TMD subtypes (Dworkin et al.[10,20], Suvinen et al.[14]) of GCPS 1.0 and GCPS 2.0 in the study population.

	GCPS 1.0 (n=180)				GCPS 2.0 (n=184)			
TMD Subtypes	1 (n=76) mean (SD)	2 (n=35) mean (SD)	3 (n=69) mean (SD)	p[#]	1 (n=86) mean (SD)	2 (n=22) mean (SD)	3 (n=76) mean (SD)	p[#]
All diagnoses	2.53 (1.53)	3.39 (1.27)	3.63 (1.54)	<.001	2.64 (1.55)	3.05 (1.12)	3.75 (1.94)	<.001
Pain-related diagnoses	1.72 (1.20)	2.56 (1.24)	2.81 (1.30)	<.001	1.81 (1.36)	2.45 (0.96)	2.87 (1.34)	<.001
Joint-related diagnoses	0.57 (0.62)	0.68 (0.64)	0.54 (0.72)	.593	0.62 (0.64)	0.50 (0.51)	0.55 (0.72)	.690

[#] Jonckheere-Terpstra test

Table 2b. Distributions (percentages) of DC/TMD Axis I diagnoses in TMD subtypes (Dworkin et al.[10,20], Suvinen et al.[14]) of GCPS 1.0 and GCPS 2.0 in the study population.

		GCPS 1.0 (n=180)				GCPS 2.0 (n=184)			
TMD Subtypes	**n**	1 (n=76)	2 (n=35)	3 (n=69)		1 (n=86)	2 (n=22)	3 (n=76)	
	n	%	%	%	p[#]	%	%	%	p[#]
Pain-related diagnoses									
Myalgia	142	53.9	82.9	83.8	<.001	58.1	90.9	82.7	<.001
Myofascial pain with referral	93	30.3	48.6	63.2	<.001	31.4	45.5	66.7	<.001
Arthralgia	140	60.5	85.7	76.5	.012	64.0	77.3	80.0	.065
Headache attributed to TMD	79	27.6	34.3	55.9	.002	25.6	31.8	58.7	<.001
Joint-related diagnoses									
Disc dislocations with reduction	34	18.4	11.4	18.8	.598	19.8	9.1	18.4	.502
- with intermittent locking	1	1.3	2.9	0.0	.412	2.3	0.0	1.3	.715
Disc dislocations without reduction with limited opening	24	38.2	34.3	18.8	.241	40.9	9.1	50.0	.667
- without limited opening	57	38.2	34.3	18.8	.033	33.7	36.4	21.1	.146
Degenerative joint disease	39	15.8	14.3	25.0	.272	18.6	4.5	26.7	.066

[#] Chi square test

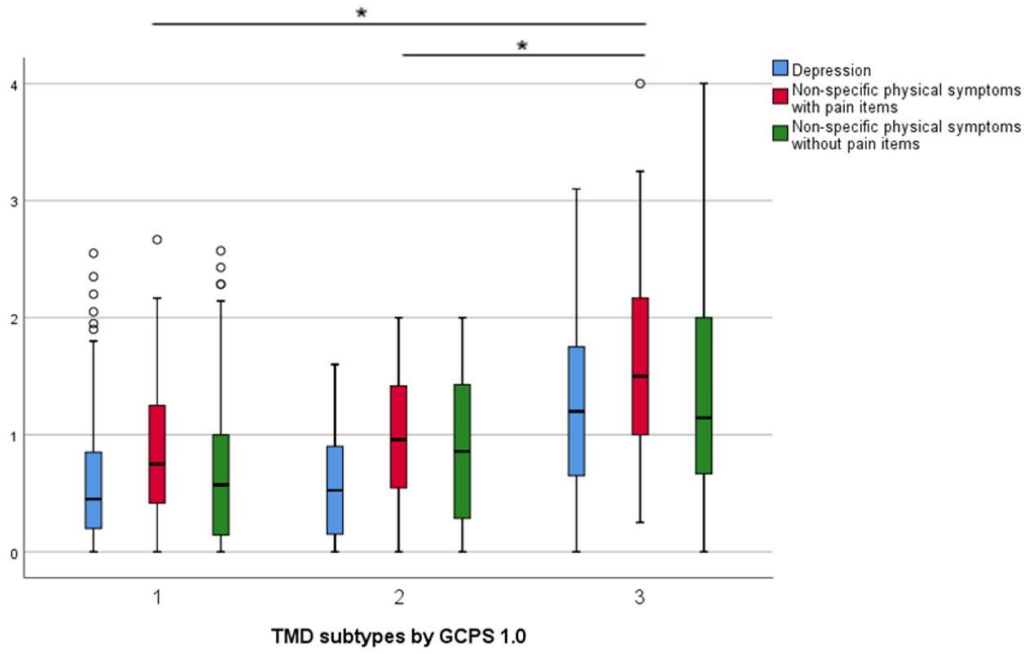

Figure 1. The boxplots of sum scores of SCL-90R depression and non-specific physical symptoms by TMD subtypes based on GCPS 1.0 in 197 TMD pain patients referred to tertiary specialist care for TMD treatment, *statistical significance between TMD subtypes, $p < 0.001$.

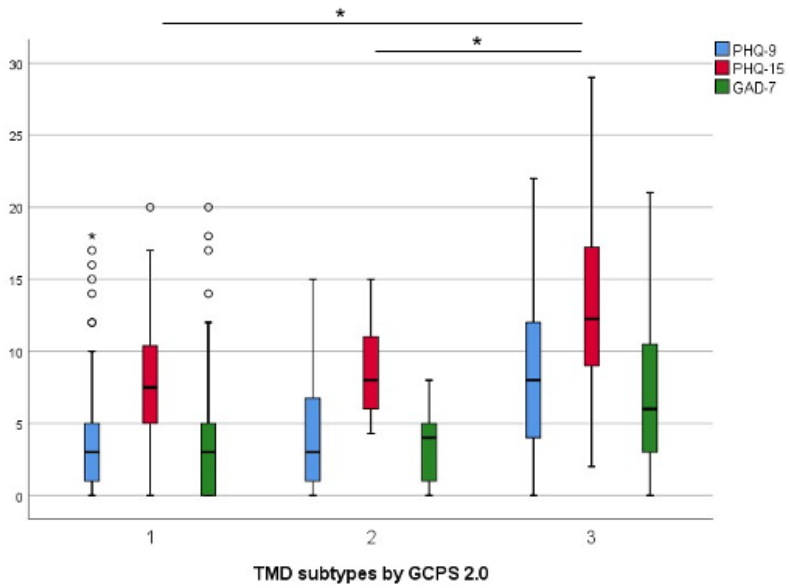

Figure 2. The boxplots of sum scores of PHQ-9 depression, PHQ-15 non-specific/somatic and GAD-7 anxiety symptoms by TMD subtypes based on GCPS 2.0 in 197 TMD pain patients referred to tertiary specialist care for TMD treatment, *statistical significance between TMD subtypes, $p < 0.001$.

Table 3. Pain data (percentage proportions) in TMD subtypes of GCPS 1.0 and 2.0 in the study population.

	GCPS 1.0 (n=180)				GCPS 2.0 (n=184)			
TMD Subtypes	1 (n=76)	2 (n=35)	3 (n=69)	p	1 (n=86)	2 (n=22)	3 (n=76)	p
PAIN duration /yrs [DC/TMD, mean (SD)]				0.044[#]				0.012[#]
	6.6 (9.7)	7.2 (9.0)	7.3 (8.6)		6.7 (9.8)	6.4 (7.3)	7.3 (8.8)	
Pain frequency (DC/TMD) (%)				<0.001[##]				<0.001[##]
no pain	3	0	1		1	0	1	
recurrent pain	74	57	36		75	50	39	
constant pain	23	43	63		24	50	60	
Comorbid pains (%)								
Head	75	91	96	0.002[##]	74	86	96	0.001[##]
Neck	81	83	96	0.031	82	86	93	0.120
Low back	70	71	75	0.752	68	55	79	0.063
Stomach	42	37	71	0.001	42	47	67	0.006
Chest	18	3	33	0.003	15	6	33	0.006
Hands	43	50	59	0.170	48	46	55	0.625
Feet	49	45	66	0.067	52	45	63	0.214
Fibromyalgia	6	11	35	<0.001	7	11	35	<0.001
Joints	53	63	68	0.205	54	70	67	0.161
Number of comorbid pain sites (0-9), mean (SD)								
	4.2 (2.0)	4.3 (1.8)	5.7 (2.3)	<0.001[#]	4.2 (2.0)	4.2 (1.7)	5.6 (2.3)	<0.001[#]

[#] Jonckheere-Terpstra test

[##] Chi Square test

Table 4. Additional biopsychosocial variables (means, SD) in the TMD subtypes of GCPS 1.0 and 2.0 in the study sample of 197 TMD pain patients referred to tertiary specialist care for TMD treatment.

	GCPS 1.0 (n=180)				GCPS 2.0 (n=184)			
TMD Subtypes	1 (n=76) mean (SD)	2 (n=35) mean (SD)	3 (n=69) mean (SD)	p[##]	1 (n=86) mean (SD)	2 (n=22) mean (SD)	3 (n=76) mean (SD)	p[##]
Self-perceived general health (1-5)[#]	2.81 (0.91)	3.11 (0.90)	3.55 (0.85)	<0.001	2.87 (1.00)	3.09 (0.87)	3.55 (0.82)	<0.001
Worry about pain (0-10)	5.22 (2.66)	6.24 (2.39)	7.65 (2.29)	<0.001	5.33 (2.50)	7.14 (2.25)	7.28 (2.46)	<0.001
Ability to control pain (0-6)	4.30 (1.33)	3.85 (1.35)	3.11 (1.21)	<0.001	4.26 (1.34)	3.86 (1.42)	3.18 (1.20)	<0.001
Ability to decrease pain (0-6)	3.50 (1.33)	3.33 (1.41)	2.77 (1.25)	0.001	3.49 (1.42)	3.32 (1.25)	2.82 (1.25)	<0.001
Anxiety (0-10)	1.95 (2.51)	1.70 (2.14)	4.00 (2.93)	<0.001	1.94 (2.69)	2.72 (2.11)	3.74 (2.87)	<0.001
Stress (0-10)	3.05 (2.52)	3.61 (2.66)	5.09 (2.78)	<0.001	3.11 (2.64)	4.56 (2.28)	4.96 (2.80)	<0.001
Sleep dysfunction (0-4)	1.00 (1.00)	1.02 (0.94)	2.16 (1.23)	<0.001	1.02 (0.90)	0.92 (1.06)	2.19 (1.21)	<0.001

[#]range in questionnaire

[##] Jonckheere-Terpstra test

Table 5. Mean (SD) number of previous consultations and self-perceived goals and treatment expectations (percentage proportions) in the TMD subtypes of GCPS 1.0 and 2.0 in the study population.

	GCPS 1.0 (n=180)				**GCPS 2.0 (n=184)**			
TMD Subtypes	1 (n=76)	2 (n=35)	3 (n=69)	p	1 (n=86)	2 (n=22)	3 (n=76)	p
Previous visit to healthcare professionals (mean, SD)								
Dentist/doctor	6.6 (12.6)	7.2 (5.5)	23.9 (35.6)	<0.001[#]	6.5 (11.9)	8.1 (5.9)	22.6 (34.8)	<0.001[#]
Other healthcare	4.7 (9.9)	5.8 (11.8)	28.2 (71.5)	<0.001	6.5 (11.9)	7.1 (14.4)	26.7 (69.1)	<0.001
Self-perceived treatment expectations (%)								
Receive information	93	91	90	0.449[##]	90	95	91	0.755[##]
Improve pain control	94	100	99	0.136	95	100	99	0.197
Improve jaw function	88	100	88	0.028	89	95	92	0.646
Increase the ability to perform daily activities	48	76	91	<0.001	50	90	90	<0.001
Improve work ability	36	48	85	<0.001	31	67	85	<0.001
Improve stress control	44	33	54	0.208	61	50	45	0.208

[#]Jonckheere-Terpstra test-

[##]Likelihood ratio test