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ORIGINAL ARTICLE

Insufficient diagnostic accuracy of a single-item questionnaire to detect psychosocial distress in temporomandibular disorder patients

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Abstract
Objectives Psychosocial assessment needs to be integrated into the diagnosis of chronic pain conditions; however, it is not clear how this assessment should be performed with minimal patient and health care provider burden. The aim of this study was to assess the diagnostic accuracy of a single-item questionnaire to detect psychosocial distress in temporomandibular disorder (TMD) patients.
Methods Presence of psychosocial distress was measured in 126 TMD patients using Research Diagnostic Criteria for TMD Axis II measures (depression, somatization, dysfunctional chronic pain). A newly developed single-item questionnaire served as a test to detect psychosocial distress. The association between the presence of distress and test results was analyzed using generalized linear models (GLM). Diagnostic accuracy of the one-item test was assessed.
Results The GLM revealed a statistically significant association between the presence of psychosocial distress and a positive test result ($p<0.001$). Psychosocially distressed patients were 70 % more likely to indicate psychosocial distress in the single-item questionnaire than patients without distress. However, diagnostic test accuracy of the single-item questionnaire was low (sensitivity 73.0 %, specificity 55.7 %). The resulting positive likelihood ratio (1.65) indicated that the single-item test is an inadequate measure for detecting psychosocial distress.
Conclusions The single-item questionnaire was not sufficiently accurate for detecting TMD patients' psychosocial distress and may therefore not be useful as an assessment tool for the various dimensions of psychosocial distress in TMD patients.
Clinical relevance Health care providers should not trust in TMD patients' responses to a single question regarding psychosocial distress. Nevertheless, this questionnaire may constitute a first step into a more profound patient–provider communication on psychological issues relevant to TMD.

Keywords Diagnostic accuracy · Psychosocial distress · RDC/TMD · Single-item questionnaire · Temporomandibular disorders

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Introduction

Psychosocial complaints remain frequently undetected in the treatment of somatic illnesses. However, psychosocial distress is a major predictor of treatment outcome [1]. If the health care provider fails to address psychosocial stressors, treatment of the obvious somatic illness may be interrupted and treatment efforts are likely to be seriously misdirected.

Psychosocial distress is a multidimensional construct that has considerable impact in chronic pain conditions such as temporomandibular disorders (TMD) [2]. The term "psychosocial distress" comprises several conditions of adversely affected psychological and social well-being (e.g., depression, somatization, anxiety, dysfunctional chronic pain). Previous findings have indicated that a higher risk of TMD treatment failure exists when patients have a diagnosis of a depressive disorder [3]. Furthermore, somatization (i.e., the expression of psychological distress as physical symptoms) is a significant predictor for poor response to treatment for TMD [4]. Patients with a history of facial pain and the co-occurrence of depression and somatization report higher levels of pain during muscle palpation and a higher number of non-specific pain conditions than those without psychosocial distress [5, 6].

Psychosocial distress is prevalent among primary care patients worldwide [7–11]. Its assessment can be performed either by the health care professional or via patient self-assessment. In the primary care setting, it has been shown that although health care providers are aware of psychosocial distress in their patients, they often fail to detect it [12–14].

Standardized self-report measures of psychosocial distress have been developed in an effort to increase its recognition. Several of these self-report questionnaires assess different dimensions of psychosocial distress such as somatization [15], depression [16, 17], and dysfunctional chronic pain [18]. However, use of lengthy questionnaires presents a considerable burden for both patients and health care providers. Therefore, several brief tools with sufficient reliability and validity have been developed to detect musculoskeletal pain patients with psychosocial risk factors or with need for additional psychosocial assessment [19–22]. Although these tools comprise less items than the questionnaires for the several dimensions of psychosocial distress, they are still comprehensive and, therefore, time-consuming.

Probably the easiest approach to assess the presence of psychosocial distress would simply be to ask the patient whether he or she suffers from distress. This single-question approach would be quick to administer and easy to interpret. As a global assessment, it would address the patient's awareness of psychosocial distress across multiple dimensions, such as the patients' consciousness of psychosocial distress, perception of the connection between distress and the current complaint, and willingness and ability to communicate the experience. In addition, administrative burden would be minimal. Use of a single-item questionnaire would be consistent with a current trend to assess important concepts of psychosocial distress with abbreviated questionnaires [23, 24].

Several single-item questionnaires have been developed and successfully tested for the assessment of self-rated health status [25], health-related quality of life [26], cancer-related mood disorders [27], physical activity [28], or female sexual dysfunction [29]. However, no single-item screening tool for the assessment of psychosocial distress among TMD patients has so far been developed or reported in accordance with the recommendations for studies of diagnostic accuracy, the Standards for Reporting of Diagnostic Accuracy (STARD) or the Quality Assessment of Diagnostic Accuracy Studies (QUADAS) criterions [30]. The objective of this study was to investigate the diagnostic accuracy of a single-item questionnaire to detect psychosocial distress in TMD patients.

Methods

Participants, study design, and setting

This cross-sectional study was performed by recruiting a convenience sample of adult patients seeking treatment for their complaints in the masticatory muscles and the temporomandibular joints (TMJs) at the Department of Prosthodontics and Materials Science, University of Leipzig (Leipzig, Germany). Recruitment occurred between January 2005 and September 2007. All patients aged 18 years or more who were determined to have at least one physical diagnosis (Axis I) according to the German version [31] of the Research Diagnostic Criteria of Temporomandibular Disorders (RDC/TMD; Table 1) [32] and who were sufficient in the German language were included in this study. Patients taking psychotropic drugs, such as antidepressants, antiepileptics, or opioids, were excluded. No further inclusion or exclusion criteria were applied. A total of 27 patients of the initial sample of 153 patients did not respond to the

Table 1 Characterization of study participants according to physical TMD diagnoses (Axis I) of the RDC/TMD

Physical TMD diagnoses (Axis I)	All patients *n* (%)[a]
I: Myofascial pain	
Ia: Myofascial pain without limited opening	36 (28.6)
Ib: Myofascial pain with limited opening	44 (34.9)
II: Disc displacement	
IIa: Disc displacement with reduction	40 (31.7)
IIb: Disc displacement without reduction with limited opening	7 (5.6)
IIc: Disc displacement without reduction without limited opening	10 (7.9)
III: Arthralgia, osteoarthritis, and osteoarthrosis	
IIIa: Arthralgia	51 (40.5)
IIIb: Osteoarthritis of the TMJ	4 (3.2)
IIIc: Osteoarthrosis of the TMJ	3 (2.4)

[a] The percentages do not add to 100 % because some subjects received multiple diagnoses

single-item questionnaire corresponding to a non-responder rate of 17.6 %. Finally, 126 patients (mean age±standard deviation 41.0±15.8 years, 77 % women) were included in the study.

The Department of Prosthodontics and Materials Science's TMD clinic, which is staffed with a small number of dentists experienced with TMD management, is the School of Dentistry's primary and secondary care clinic where TMD patients are diagnosed and treated. When necessary, patients are referred to other health care providers within and outside the university. Patients were either self-referred to the TMD clinic or were referred by their dentist, physician, or physiotherapist.

The study protocol (no.: 146-2005) was reviewed and approved by the Institutional Review Board of the School of Medicine of the University of Leipzig. All study participants gave their signed informed consent.

Diagnosis of psychosocial distress according to the RDC/TMD

Whereas the RDC/TMD Axis I involves physical assessment according to a standardized protocol, the second axis (Axis II) of the RDC/TMD involves assessment of the psychosocial, functional, and behavioral aspects of TMD. The German version of the RDC/TMD is essentially identical to the English-language original and includes the Graded Chronic Pain Scale (GCPS) score, a jaw disability score, and measures to assess depression and somatization. The only difference in the German version from the English-language original is that the depression and somatization constructs are assessed according to recommendations of the working group on pain assessment of the German Chapter of the International Association for the Study of Pain [33]. The 20-item "General Depression Scale" (German: *Allgemeine Depressionsskala)* [34], which is the German translation of the Center for Epidemiological Studies Depression Scale [35], was used to assess depression, and the "Complaints List" (German: *Beschwerdenliste*) [36], a 24-item instrument, was used to assess somatization.

Population-based normative data are available for these instruments, which allow the classification of "normal," "moderately increased" (above the 70th percentile on population norms), and "severely increased" (above the 90th percentile on population norms) scores of depression or somatization; severe is the categorization recommended by the original English-language RDC/TMD. Thus, patients with severely increased scores of depression or somatization, or with dysfunctional chronic pain (GCPS grade III or IV) were classified as psychosocially distressed. We preferred including only "severely" affected patients in the distressed group over the inclusion of patients with "moderate" symptoms because the latter may not always indicate a need for treatment. Jaw disability scores were not included in the classification of the psychosocial distress construct. The jaw disability scale is only a checklist without supporting psychometric data and does not have face validity as a measure of this construct [37].

Some patients had missing data for General Depression Scale (n=10, 7.9 %) and Complaints List (n=4, 3.2 %). Only participants who had TMD pain within the 6 months prior to this study completed the GCPS (n=108, 85.7 %).

Reliability of RDC/TMD examination has been investigated in previous reports and found to be sufficient [38, 39]. Internal consistency, a measure for the scale's reliability assessed by calculating Cronbach's alpha, was 0.86 for GCPS, 0.90 for Complaints List, and 0.89 for General Depression Scale.

Single-item test to detect psychosocial distress

The test to detect psychosocial distress involved a single-item questionnaire using the following question: "Do you suffer from psychosocial distress that may contribute to your current physical complaints?" (original German wording: *Können Sie sich vorstellen, dass psychische Faktoren im Zusammenhang mit Ihren Beschwerden eine Rolle spielen?*) with the response categories: "Yes" and "No." The single-item questionnaire was developed in a group of experts in TMD management (dentists and psychologists).

Patients responded after filling out the provided psychosocial questionnaires and after completing the physical examination (including assessment of pain characteristics). This approach resulted in a time gap of approximately 20 to 30 min between completing the single-item and psychosocial questionnaires. When responding to the single-item questionnaire, the patients had no access to the completed psychosocial questionnaires. The dentist was available for help to answer the question if needed but did not communicate results of the psychosocial questionnaires to the patients before or while responding to the single-item questionnaire. Blinding of the dentist was not performed.

Data analyses

Presence of psychosocial distress according to RDC/TMD Axis II measures was presented as proportions for all patients and stratified by age (two groups were derived using the median participant age of 42 years as cutoff) and gender. Differences between subgroups in proportions of patients with psychosocial distress were calculated using a chi-square test.

To compare the presence of psychosocial distress as diagnosed with RDC/TMD instrument with the single-item test, prevalence rate ratios (PRR) were computed using a general linear model (GLM) with binominal distribution and

iterated, reweighted least-squares optimization of the deviance with adjustment for age group and gender. These measures are similar to positive likelihood ratios; for example, a PRR of 1.4 would indicate that a positive test result is 1.4 times more likely (equivalent to a 40 % increase) in patients with psychosocial distress than in patients without distress.

The accuracy of the single-item questionnaire as a brief test to predict the patient's psychosocial distress as indicated by the different comprehensive questionnaires (Axis II measures) was assessed and described following recommendations of STARD and QUADAS [30]. The classification of patients' psychosocial distress, based on the RDC/TMD questionnaires, was considered the criterion, and diagnostic test accuracy measures such as sensitivity, specificity, and positive and negative predictive values (including 95 % confidence intervals (CIs)) were calculated. In addition, we calculated positive and negative likelihood ratios, including CIs. Likelihood ratios can be calculated directly from sensitivity and specificity and can be used to derive posttest odds by multiplying the pretest odds by the likelihood [40]. The positive likelihood ratio describes the ratio of the probability of the positive test result in patients with psychosocial distress to the probability in patients who do not have distress, whereas the negative likelihood ratio describes the ratio of the probability of the negative test result in patients with psychosocial distress to the probability in patients who do not have distress [41]. Therefore, likelihood ratios can help adapt the results of a study to patients. According to guidelines for the goodness of diagnostic tests, likelihood ratio values of more than 10 or less than 0.1 represent "convincing" diagnostic evidence, values between 5–10 and 0.1–0.2 represent "high" diagnostic evidence, values between 2–5 and 0.2–0.5 represent "weak" diagnostic evidence, and values between 0.5–2 represent "hardly relevant" diagnostic evidence [42]. The analyses of diagnostic test accuracy have been performed in all patients and in strata according to age group and gender.

We computed an additional sensitivity analysis using the cutoff score of normal vs. moderate/severe to test whether diagnostic accuracy of the test depends on the definition of the threshold for psychosocial distress. All analyses were performed using the statistical software package STATA (Stata Statistical Software: Release 12. College Station, TX: StataCorp LP), with the probability of a type I error set at the 0.05 level.

Results

Prevalence of psychosocial distress and results of the single-item test

When higher levels of somatization, depression, or graded chronic pain were combined into a single indicator for the presence of psychosocial distress, prevalence of psychosocial distress reached 37.8 % in our TMD patients (Table 2). Neither age nor gender influenced prevalence of psychosocial distress statistically significantly (chi-square test: both $p>0.05$).

A somewhat higher percentage of patients (48.4 %) indicated psychosocial distress in the single-item questionnaire. Neither age nor gender had a statistically significant effect on test results (chi-square test: both $p>0.05$).

Association between psychosocial distress and single-item test results

The GLM revealed a statistically significant association between the presence of psychosocial distress and a positive test result, i.e., psychosocially distressed patients were 65 % ($p<0.01$) more likely to indicate psychosocial distress in the single-item questionnaire than patients without distress. If the analysis was controlled for age group and gender, the result was almost identical (PRR 1.70, $p<0.001$).

However, sensitivity and specificity of the single-item questionnaire were low (Table 3): only 73.0 % of the distressed patients and only 55.7 % of the non-distressed patients were correctly identified. In addition, the positive and negative predictive values were low: 50.0 % of the patients who indicated distress in the single-item test were actually distressed and 77.3 % of the patients who did not indicate distress with the brief instrument were truly non-distressed. When values of sensitivity, specificity, and positive and negative predictive values were investigated in gender and age groups, the results did not change substantially.

A positive response to the question regarding psychosocial distress increased the probability of truly being distressed from 37.8 % (prevalence of psychosocial distress, i.e., pretest probability) to 50.0 % (posttest probability or positive predictive value). This is equivalent to a positive likelihood ratio (LR+) of 1.65 (Table 3). The values for LR+ varied only from 1.43 to 1.95 across the subgroups (gender, age group). All these values are considered hardly relevant for a diagnostic test [42].

The negative likelihood ratio (LR−) was 0.49, i.e., the proportion of single-item-test-diagnosed non-distressed patients among patients with distress was lower in comparison with the proportion of non-distressed patients among patients without distress. LR− varied from 0.17 to 0.61 across the subgroups (gender, age group). Only the LR− among men and among subjects in the younger age group fell below the value of 0.50, which is considered to be the border for weak diagnostic evidence [42]. However, the 95 % CI was wide and included the value 1, meaning that the LR− was not statistically significantly different from the value representing no effect. Therefore the LR− was considered hardly relevant [42] for a single-item test to identify non-distressed patients.

Table 2 Classification of participants according to Axis II measures of the RDC/TMD and to the diagnostic test results regarding presence of psychosocial distress for all patients and stratified by gender and age group

RDC/TMD Axis II measure or diagnostic test result		All patients	Gender		Age group	
		n (%)	*n* (%)		*n* (%)	
			Men	Women	18–41 years	42–80 years
Non-specific physical symptoms[a,b]	Normal	64 (52.5)[c]	13 (44.8)	51 (54.8)	36 (60.0)	28 (45.2)
	Moderate	29 (23.8)[c]	8 (27.6)	21 (22.6)	13 (21.7)	16 (25.8)
	Severe	29 (23.8)[c]	8 (27.6)	21 (22.6)	11 (18.3)	18 (29.0)
Depression[a,d]	Normal	83 (71.6)	15 (55.6)	68 (76.4)	39 (67.2)	44 (75.9)[c]
	Moderate	23 (19.8)	8 (29.6)	15 (16.9)	12 (20.7)	11 (19.0)[c]
	Severe	10 (8.6)	4 (14.8)	6 (6.7)	7 (12.1)	3 (5.2)[c]
Chronic pain[e,f]	Grade I	37 (34.3)	9 (32.1)[c]	28 (35.0)	22 (37.9)	15 (30.0)
	Grade II	48 (44.4)	14 (50.0)[c]	34 (42.5)	25 (43.1)	23 (46.0)
	Grade III	13 (12.0)	3 (10.7)[c]	10 (12.5)	4 (6.9)	9 (18.0)
	Grade IV	10 (9.3)	2 (7.1)[c]	8 (10.0)	7 (12.1)	3 (6.0)
Psychosocial distress[g]	Negative	61 (62.2)	15 (57.7)	46 (63.9)	37 (69.8)	24 (53.3)
	Positive	37 (37.8)	11 (42.3)	26 (36.1)	16 (30.2)	21 (46.7)
Diagnostic test	Negative	65 (51.6)	12 (41.4)	53 (54.6)	32 (51.6)	33 (51.6)
	Positive	61 (48.4)	17 (58.6)	44 (45.4)	30 (48.4)	31 (48.4)

[a] Moderate: above the 70th percentile on population norms; severe: above the 90th percentile on population norms

[b] N=4 (3.2 %) participants were missing data for analysis of somatization

[c] Values do not sum to 100.0 % due to rounding

[d] N=10 (7.9 %) participants were missing data for analysis of depression

[e] N=18 (14.3 %) participants were missing data for analysis of chronic pain

[f] Functional chronic pain is grades I–II; dysfunctional chronic pain is grades III–IV

[g] N=28 (22.2 %) participants were missing data for analysis of the presence of psychosocial distress

Using the cutoff score of normal vs. moderate/severe in the sensitivity analysis resulted in a prevalence of psychosocial distress of 61.2 % in our TMD patients. Sensitivity and specificity were 65.0 and 60.5 %, respectively. Positive and negative predictive values were low (72.2 and 52.3 %, respectively). LR+ (1.65) and LR− (0.58) were considered hardly relevant for a diagnostic test [42].

Discussion

This is the first study that has investigated the diagnostic accuracy of a single-item instrument to detect psychosocial distress assessed with widely used and well-accepted instruments among TMD patients. Despite a substantial interest in psychosocial conditions and their impact on treatment effects in chronic pain conditions, self-assessment of psychosocial

Table 3 Characteristics of the single-item questionnaire for psychosocial distress as a diagnostic test including 95 % confidence intervals for all patients and stratified by gender and age group

	All patients	Gender		Age group	
		Men	Women	18–41 years	42–80 years
Sensitivity	73.0 (55.9–86.2)	90.9 (58.7–99.8)	65.4 (44.3–82.8)	75.0 (47.6–92.7)	71.4 (47.8–88.7)
Specificity	55.7 (42.4–68.5)	53.3 (26.6–78.7)	56.5 (41.1–71.1)	59.5 (42.1–75.2)	50.0 (29.1–70.9)
PPV	50.0 (36.1–63.9)	58.8 (32.9–81.6)	45.9 (29.5–63.1)	44.4 (25.5–64.7)	55.6 (35.3–74.5)
NPV	77.3 (62.2–88.5)	88.9 (51.8–99.7)	74.3 (56.7–87.5)	84.6 (65.1–95.6)	66.7 (41.0–86.7)
LR+	1.65 (1.17–2.32)	1.95 (1.10–3.45)	1.50 (0.98–2.32)	1.85 (1.14–3.00)	1.43 (0.88–2.32)
LR–	0.49 (0.27–0.86)	0.17 (0.02–1.17)	0.61 (0.34–1.10)	0.42 (0.17–1.02)	0.57 (0.26–1.25)

PPV positive predictive value, *NPV* negative predictive value, *LR+* and *LR−* positive and negative likelihood ratios, respectively

distress using a global single question has so far not been investigated.

For a single-item questionnaire to be useful for detecting psychosocial distress, two conditions are necessary. First, the answer to the particular question should depend on the true psychosocial state, i.e., in patients that are truly psychosocially distressed positive test results should be substantially higher than among non-distressed patients. Second, the question should have sufficient diagnostic accuracy to discriminate between distressed and non-distressed patients [30].

This study demonstrated that truly psychosocially distressed patients reported more distress than non-distressed patients. This result challenges a finding by Kirmayer and Robbins [43], who showed that true somatizers were less likely to attribute common physical findings to psychological causes and more likely to attribute them to normal physical illness or environmental conditions. Differences in study design, especially in the investigated population, may explain the differences in findings. For example, Kirmayer and Robbins included only patients with depression and anxiety with respect to somatic presentations of these psychosocial conditions [43].

Although patients with psychosocial distress more often indicated being distressed in the single-item questionnaire, a substantial number of psychosocially distressed people did not indicate the presence of distress when approached with the global question.

The low agreement between the presence and self-report of distress may be due to several reasons. The single-item questionnaire asks patients directly for the presence of psychosocial distress, whereas the true presence of psychosocial distress is indirectly concluded from the answers to several items in several questionnaires. The comprehensive psychosocial questionnaires assess several different symptoms related to predefined psychosocial construct (e.g., depression) without telling the patient explicitly what construct is intended to be measured. Therefore, patients might not recognize that they actually provide information about their psychosocial well-being. The single-item questionnaire asks directly whether patients suffer from psychosocial distress. This situation may create the opportunity for secondary gain [44]. In this psychological phenomenon, patients benefit from their pain in the form of attention and sympathy. Therefore, they will not report that their painful conditions are influenced by their psychology, nor do they express any need for the help of a specialist in mental health. Therefore, for some patients, secondary gain may be a potential reason for providing an affirmative answer to the presence of psychosocial distress in the single-item questionnaire.

However, for some patients, denying psychosocial distress may also be desirable because they may perceive the presence of psychosocial distress as a stigma similar to the presence of a mental illness [45]. Therefore, some patients may know that they are psychosocially distressed or that they need treatment, but they are reluctant to admit it [46]. This reluctance is common among TMD patients, and it helps to explain the difficulty establishing appropriate comprehensive TMD treatment plans, which include cognitive and behavioral therapy, for these patients.

We applied the cutoff score of normal/moderate vs. severe to identify psychosocially distressed patients. This approach aimed to identify patients with treatment need for psychosocial distress and not patients with only moderate symptoms without treatment need. Using another cutoff score might change the results. Therefore, we computed a sensitivity analysis using the cutoff score of normal vs. moderate/severe to test whether diagnostic accuracy of the test depends on the definition of the threshold for psychosocial distress. Although measures of diagnostic test accuracy changed, neither likelihood ratios nor predictive values reached the threshold for clinically relevant diagnostic evidence.

Strengths and limitations

Use of standardized internationally compatible instruments allows comparison of results across studies. The RDC/TMD is a standardized measure with several language versions in addition to the English-language original. Reports about the translation process, the calibration of clinical examiners, and the evaluation of psychometric properties have been published [39, 47].

Our cross-sectional study is based on a typical TMD patient population. Patients were predominately female (77 %), which is in accordance with other studies of TMD patients [48, 49]. Approximately 28 % of our patients had moderately or severely increased scores for depression, and 48 % exhibited moderate or severe levels of medically unexplained non-specific physical symptoms (somatization). A study conducted by Yap et al. investigating depression and somatization in TMD patients found comparable levels of depression (39 %) and somatization (55 %) [50]. Not unexpectedly, depression and somatization were correlated ($r=0.62$, $p<0.001$) in our study. This finding is also comparable to the study conducted by Yap et al., who reported a correlation coefficient of 0.73. Approximately 21 % of our patients had dysfunctional chronic pain (GCPS grades III and IV). This proportion is only somewhat higher than the 15 % reported by Manfredini et al. obtained in 111 treatment-seeking TMD patients in Italy [49].

Psychosocial distress was defined using measures and categories contained in the Axis II of the RDC/TMD. The association between the presence and report of distress could change if a different framework using psychometrics designed to assess other psychosocial factors than those within the RDC/TMD were used. For example, other measures, such as anxiety and/or personality disorders, could be considered. Dworkin et al. have suggested that the RDC/TMD Axis II measures capture core psychosocial domains

for TMD patients [32, 37]. In addition, given that psychosocial concepts (e.g., depression and anxiety) are substantially correlated [51], it is likely that the RDC/TMD Axis II instruments also capture psychosocial distress related to other concepts. Therefore, we believe that our findings would not be substantially different if assessment of other psychosocial concepts were included.

The measures contained in the Axis II of the RDC/TMD (especially for depression and somatization), used as criterions for psychosocial distress in our study, do not result in clinical diagnoses of psychiatric disorders (e.g., major depressive disorders). They give only an indication of the presence of the disorders and represent comprehensive screening tools. However, Axis II measures of the German version of the RDC/TMD have been shown to be valid tools to detect depression [34, 52], somatization [36], and dysfunctional chronic pain [18]. Furthermore, clinical utility for TMD patients has been proven [37].

We did not include clinical data such as blood pressure or cortisol level as further indicators for psychosocial distress. Therefore, our definition of psychosocial distress was based only on the results of the RDC/TMD Axis II measures. Future studies might also include clinical stress indicators.

Although the distribution of physical diagnoses (RDC/TMD Axis I) in the present study was not substantially different from other TMD studies, the distribution of RDC/TMD Axis II diagnoses may be different among TMD clinical centers around the world. Therefore, responses to the question regarding psychosocial distress may differ from setting to setting. Our clinic is largely a primary and secondary care center; TMD's psychosocial impact is likely less pronounced in our clinic than in tertiary care centers.

The high percentage of women in the study population does not appear to be a limitation for generalizability of the results. Although women are more willing to admit discomfort and report more disability due to illness [53], stratified analyses did not reveal major differences between women and men in our study, making the results comparable with populations with other distributions of gender.

We could not assess test–retest reliability of the single-item questionnaire. The test was applied in routine clinical practice with several interventions directly following the assessment (e.g., education). Therefore, asking the patient the same question some days later would have been affected by interventions of the treating dentist. This prevented us from the assessment of test–retest reliability. Of course, internal consistency as another measure of reliability cannot be calculated for a single-item questionnaire, and inter-rater reliability cannot be assessed since the questionnaire is self-administered. Therefore, limited reliability might also affect the low diagnostic accuracy of the test.

The single-item question regarding psychosocial distress is a global measure. Its aspects comprise patients' consciousness of psychosocial distress, perception of the connection between that distress and the current complaint, and willingness and ability to communicate that experience. Due to the fact that we assessed these multiple dimensions with a single question, we are not able to tell whether the failure of the single question as a diagnostic instrument for psychosocial distress in TMD patients depends on single or multiple dimensions. Patients might recognize that they are psychosocially distressed but do not relate this distress to their physical complaints. Furthermore, a positive response to the questionnaire depends substantially on the willingness and ability to communicate about psychosocial distress. Patients might recognize psychosocial distress and the relationship with their physical complaints but are reluctant to admit it. However, this single question will facilitate doctor–patient communication, and further information on the specific aspects can be gathered in a following talk between doctor and patient.

Although the use of either the single-item questionnaire as investigated in this study or the dentists' impressions as already shown in a previous study [54] forms insufficient diagnostic procedures to identify psychosocial distress in a TMD population, the combination of both diagnostic approaches might be promising for the assessment of psychosocial distress. In addition, other brief questionnaires such as the PHQ-4 for depression and anxiety could be applied in TMD patients as screening tools [55]. However, future research is necessary to investigate whether the suggested approach to assess psychosocial distress in TMD patients is feasible in daily clinical practice and results in improved treatment outcomes as supposed.

Clinical implications

Diagnosis of psychosocial distress is important for chronic pain patients for two reasons. First, patients' pain management would be affected. Without addressing psychosocial distress, treatment strategies focusing on the somatic aspects of the patient's physical complaints may be emphasized, when in fact psychosocial aspects may be major contributors to the patient's physical condition and its prognosis. In such cases, addressing chronic pain conditions, including TMD, from a biopsychosocial model should optimize chances for treatment success. Second, patients, who are aware of their psychosocial distress, are better able to communicate with health care providers in a manner that ensures their psychosocial distress will not be overlooked. This enhances treatment outcome by raising the possibility for alternative forms of care, particularly psychological care. If patients are not aware of their psychosocial distress, when they are in fact substantially distressed, compliance with effective treatment strategies may be limited.

Our study's finding that TMD patients indicated the presence of psychosocial distress is encouraging and clinically

useful. Patients with other chronic pain disorders, including back pain, headache, and fibromyalgia, may also have similar levels of awareness of psychosocial distress. Even if the single-item questionnaire is not predictive for the individual chronic pain patient, asking this question may nevertheless be useful because it prompts the patient to think about important contributors to his or her condition. Patients may endorse a number of items on a psychosocial symptom checklist without being aware that they are in appreciable, general psychosocial distress. In contrast with more comprehensive instruments, the information that the clinician gains with the single-item questionnaire regarding whether the patient is aware of being distressed may be of diagnostic value. Therefore, we recommend considering this single-question approach for clinical practice. Its use may generate information that more comprehensive assessment instruments miss regarding the presence or absence of patient awareness regarding psychosocial distress. Perhaps most importantly, use of this single question may facilitate doctor–patient communication to become more holistic and clinically useful.

Conclusion

Although test results were associated with the presence of psychosocial distress and the test may facilitate doctor–patient communication, the single-item questionnaire had insufficient diagnostic accuracy as a brief test to detect psychosocial distress in TMD patients. Whereas the generalizability of our findings to other possible single-item or short instruments is difficult to determine, it seems that providing the TMD clinician with an easy and simple tool to determine the presence or absence of clinically relevant construct of psychosocial distress is very likely not to be accomplished by just asking one question.

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Conflict of interest The authors declare that they have no conflict of interest.

References

1. Westman A, Linton SJ, Ohrvik J, Wahlen P, Leppert J (2008) Do psychosocial factors predict disability and health at a 3-year follow-up for patients with non-acute musculoskeletal pain? A validation of the Orebro Musculoskeletal Pain Screening Questionnaire. Eur J Pain 12:641–649
2. Reissmann DR, John MT, Wassell RW, Hinz A (2008) Psychosocial profiles of diagnostic subgroups of temporomandibular disorder patients. Eur J Oral Sci 116:237–244
3. Tversky J, Reade PC, Gerschman JA, Holwill BJ, Wright J (1991) Role of depressive illness in the outcome of treatment of temporomandibular joint pain-dysfunction syndrome. Oral Surg Oral Med Oral Pathol 71:696–699
4. McCreary CP, Clark GT, Oakley ME, Flack V (1992) Predicting response to treatment for temporomandibular disorders. J Craniomandib Disord 6:161–169
5. Yap AU, Chua EK, Tan KB, Chan YH (2004) Relationships between depression/somatization and self-reports of pain and disability. J Orofac Pain 18:220–225
6. Yap AU, Chua EK, Dworkin SF, Tan HH, Tan KB (2002) Multiple pains and psychosocial functioning/psychologic distress in TMD patients. Int J Prosthodont 15:461–466
7. Scherer M, Himmel W, Stanske B et al (2007) Psychological distress in primary care patients with heart failure: a longitudinal study. Br J Gen Pract 57:801–807
8. Demertzis KH, Craske MG (2006) Anxiety in primary care. Curr Psychiatry Rep 8:291–297
9. Fink P, Sorensen L, Engberg M, Holm M, Munk-Jorgensen P (1999) Somatization in primary care. Prevalence, health care utilization, and general practitioner recognition. Psychosomatics 40:330–338
10. Nordstrom A, Bodlund O (2008) Every third patient in primary care suffers from depression, anxiety or alcohol problems. Nord J Psychiatry 62:250–255
11. Fink P, Jensen J, Borgquist L et al (1995) Psychiatric morbidity in primary public health care: a Nordic multicentre investigation. Part I: method and prevalence of psychiatric morbidity. Acta Psychiatr Scand 92:409–418
12. Becker SM (2004) Detection of somatization and depression in primary care in Saudi Arabia. Soc Psychiatry Psychiatr Epidemiol 39:962–966
13. Eisenberg L (1992) Treating depression and anxiety in primary care. Closing the gap between knowledge and practice. N Engl J Med 326:1080–1084
14. Higgins ES (1994) A review of unrecognized mental illness in primary care. Prevalence, natural history, and efforts to change the course. Arch Fam Med 3:908–917
15. Derogatis LR, Lipman RS, Covi L (1973) SCL-90: an outpatient psychiatric rating scale—preliminary report. Psychopharmacol Bull 9:13–28
16. Beck AT, Steer RA (1987) Beck depression inventory—manual. The Psychological Association, San Antonio
17. Kroenke K, Spitzer RL, Williams JB (2001) The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med 16:606–613
18. Von Korff M, Ormel J, Keefe FJ, Dworkin SF (1992) Grading the severity of chronic pain. Pain 50:133–149
19. Linton SJ, Hallden K (1998) Can we screen for problematic back pain? A screening questionnaire for predicting outcome in acute and subacute back pain. Clin J Pain 14:209–215
20. Hill JC, Dunn KM, Lewis M et al (2008) A primary care back pain screening tool: identifying patient subgroups for initial treatment. Arthritis Rheum 59:632–641
21. Main CJ, Wood PL, Hollis S, Spanswick CC, Waddell G (1992) The Distress and Risk Assessment Method. A simple patient classification to identify distress and evaluate the risk of poor outcome. Spine (Phila Pa 1976) 17:42–52
22. Apeldoorn AT, Bosselaar H, Ostelo RW et al (2012) Identification of patients with chronic low back pain who might benefit from additional psychological assessment. Clin J Pain 28:23–31
23. Löwe B, Kroenke K, Grafe K (2005) Detecting and monitoring depression with a two-item questionnaire (PHQ-2). J Psychosom Res 58:163–171
24. Kriston L, Holzel L, Weiser AK, Berner MM, Harter M (2008) Meta-analysis: are 3 questions enough to detect unhealthy alcohol use? Ann Intern Med 149:879–888
25. Bowling A (2005) Just one question: If one question works, why ask several? J Epidemiol Community Health 59:342–345

26. Cunny KA, Perri M 3rd (1991) Single-item vs multiple-item measures of health-related quality of life. Psychol Rep 69:127–130
27. Mitchell AJ (2007) Pooled results from 38 analyses of the accuracy of distress thermometer and other ultra-short methods of detecting cancer-related mood disorders. J Clin Oncol 25:4670–4681
28. Milton K, Bull FC, Bauman A (2011) Reliability and validity testing of a single-item physical activity measure. Br J Sports Med 45:203–208
29. Kriston L, Gunzler C, Rohde A, Berner MM (2010) Is one question enough to detect female sexual dysfunctions? A diagnostic accuracy study in 6,194 women. J Sex Med 7:1831–1841
30. Cook C, Cleland J, Huijbregts P (2007) Creation and critique of studies of diagnostic accuracy: use of the STARD and QUADAS methodological quality assessment tools. J Man Manip Ther 15:93–102
31. John MT, Hirsch C, Reiber T, Dworkin S (2006) Translating the research diagnostic criteria for temporomandibular disorders into German: evaluation of content and process. J Orofac Pain 20:43–52
32. Dworkin SF, LeResche L (1992) Research diagnostic criteria for temporomandibular disorders: review, criteria, examinations and specifications, critique. J Craniomandib Disord 6:301–355
33. Kröner-Herwig B, Denecke H, Glier B et al (1996) Qualitätssicherung in der Therapie chronischen Schmerzes. Ergebnisse einer Arbeitsgruppe der Deutschen Gesellschaft zum Studium des Schmerzes (DGSS) zur psychologischen Diagnostik. IX. Multidimensionale Verfahren zur Erfassung schmerzrelevanter Aspekte und Empfehlungen zur Standarddiagnostik. Schmerz 10:47–52
34. Hautzinger M, Bailer M (1995) Allgemeine Depressionsskala (ADS). Beltz, Weinheim
35. Radloff L (1977) The CES-D scale: a self-report depression scale for research in the general population. Appl Psychol Meas 1:385–401
36. Von Zerssen D (1976) Die Beschwerden-Liste. Beltz, Weinheim
37. Dworkin SF, Sherman J, Mancl L, Ohrbach R, LeResche L, Truelove E (2002) Reliability, validity, and clinical utility of the Research Diagnostic Criteria for Temporomandibular Disorders Axis II Scales: depression, non-specific physical symptoms, and graded chronic pain. J Orofac Pain 16:207–220
38. John MT, Zwijnenburg AJ (2001) Interobserver variability in assessment of signs of TMD. Int J Prosthodont 14:265–270
39. Schmitter M, Ohlmann B, John MT, Hirsch C, Rammelsberg P (2005) Research Diagnostic Criteria for Temporomandibular Disorders: a calibration and reliability study. Cranio 23:212–218
40. Deeks JJ, Altman DG (2004) Diagnostic tests 4: likelihood ratios. BMJ 329:168–169
41. McGee S (2002) Simlipfying likelihood ratios. J Gen Intern Med 17:647–650
42. Jaeschke R, Guyatt GH, Sackett DL (1994) User's guide to the medical literature. III. How to use an article about a diagnostic test. B. What are the results and will they help me in caring for my patients? J Am Med Assoc 271:703–707
43. Kirmayer LJ, Robbins JM (1996) Patients who somatize in primary care: a longitudinal study of cognitive and social characteristics. Psychol Med 26:937–951
44. Gatchel RJ (2004) Psychosocial factors that can influence the self-assessment of function. J Occup Rehabil 14:197–206
45. Hayward P, Bright JA (1997) Stigma and mental illness: a review and critique. J Ment Health 6:345–354
46. Barney LJ, Griffiths KM, Jorm AF, Christensen H (2006) Stigma about depression and its impact on help-seeking intentions. Aust N Z J Psychiatry 40:51–54
47. Lobbezoo F, van Selms MK, John MT et al (2005) Use of the Research Diagnostic Criteria for Temporomandibular Disorders for multinational research: translation efforts and reliability assessments in The Netherlands. J Orofac Pain 19:301–308
48. Wolf E, Petersson K, Petersson A, Nilner M (2001) Long-lasting orofacial pain—a study of 109 consecutive patients referred to a pain group. Swed Dent J 25:129–136
49. Manfredini D, Borella L, Favero L, Ferronato G, Guarda-Nardini L (2010) Chronic pain severity and depression/somatization levels in TMD patients. Int J Prosthodont 23:529–534
50. Yap AU, Tan KB, Chua EK, Tan HH (2002) Depression and somatization in patients with temporomandibular disorders. J Prosthet Dent 88:479–484
51. Pandey M, Devi N, Thomas BC, Kumar SV, Krishnan R, Ramdas K (2007) Distress overlaps with anxiety and depression in patients with head and neck cancer. Psychooncology 16:582–586
52. Weissman MM, Sholomskas D, Pottenger M, Prusoff BA, Locke BZ (1977) Assessing depressive symptoms in five psychiatric populations: a validation study. Am J Epidemiol 106:203–214
53. Wool CA, Barsky AJ (1994) Do women somatize more than men? Gender differences in somatization. Psychosomatics 35:445–452
54. John MT, Selle D (1998) Assessment of personality traits in patients with craniomandibular disorders. Dtsch Zahnarztl Z 8:547–550
55. Löwe B, Wahl I, Rose M et al (2010) A 4-item measure of depression and anxiety: validation and standardization of the Patient Health Questionnaire-4 (PHQ-4) in the general population. J Affect Disord 122:86–95