Research letter

Initial assessment of the psycho-emotional state of patients with temporomandibular disorders: A pilot study

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None declared

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Abstract

Background. Temporomandibular disorders (TMD) are a group of conditions that affect the function of the masticatory muscles, temporomandibular joints and surrounding structures.

Objectives. The objective of the preliminary investigation was to develop an initial questionnaire for emotional assessment, pre-designed for TMD patients, and provide guidance for further management through referral to psychological and/or psychiatric counseling. Additionally, we aimed to compare the results of tests carried out in TMD patients with those of healthy subjects.

Material and methods. The study involved 260 patients who reported for dental treatment. The TMD study group (Group 1, $n = 130$) consisted of patients diagnosed with TMD, and the control group (Group 2, $n = 130$) had TMD diagnostically excluded. The questionnaire included 30 questions about the emotional state of the patients in the past 4 weeks.

Results. The mean scores were 37.715 points for Group 1 (median (Me) = 35.5, standard deviation (SD) = 12.58 and 24.938 points for Group 2 ($Me = 24$, $SD = 7.95$) ($p < 0.001$).

Conclusions. The research suggests that the developed questionnaire is useful for an initial assessment of the psycho-emotional state of TMD patients. Furthermore, the results emphasize a greater need for psychological counseling in TMD patients compared to their healthy counterparts.

Keywords: anxiety, stress, questionnaire, temporomandibular disorders, TMD

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Introduction

Temporomandibular disorders (TMD) are a group of clinical conditions that affect the function of the masticatory muscles, temporomandibular joints and the surrounding structures. They are a significant cause of orofacial pain, along with dental pain. In TMD, pain is often caused by overloading the masticatory muscles rather than by primary joint changes. Temporomandibular disorders have a multifactorial and complex etiopathogenesis.[1–3] Psycho-emotional disorders (excessive nervous excitability, anxiety and depression) are a critical etiological factor of this condition, as confirmed by numerous studies.[4–11] However, several other factors may also contribute to TMD development.

An increase in stress levels (psycho-emotional tension) is a crucial factor affecting the state of masticatory function. Structures such as the hypothalamus, the reticular formation and the limbic system have a decisive influence on the patient's emotional state.[1,2,12–15] The activity of the limbic system, which governs emotions, and the additional connections of the gamma loops to the masticatory muscles, determine that increased emotional tension results in a significant increase in the contractile activity of the masticatory muscles.[16]

Temporomandibular disorders and functional disorders of the masticatory muscles are the most common complaints of patients seeking treatment in the dental office. The primary symptoms of TMD are pain and dysfunction, with myalgia being most commonly caused by increased muscle use, which is related to arterial vasoconstriction and accumulation of metabolic waste products in the muscles. Activities such as daytime teeth clenching, gum chewing, and biting lips, fingernails or cheeks cause significant strain on the masticatory muscles and temporomandibular joints.[1,15] Karacay and Sahbaz evaluated the relationship between TMD type and the occurrence of probable sleep bruxism and awake bruxism, demonstrating an association with TMD-related pain and intra-articular joint disorders.[16]

The relationship between psychological factors and clinical pain is well established. Numerous cross-sectional studies show that individuals with chronic pain exhibit higher levels of psychological distress, environmental stress and somatic symptoms than those without pain.[7–9,17,18] Additionally, chronic TMD cases differ from controls in terms of personality traits, such as neuroticism.[6–9,17,18] Diagnostic procedures use the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) questionnaire axis II (biobehavioral questionnaires), which predominantly focuses on pain assessment, with the patient's emotional state (point 20) evaluated to a very limited extent.[2] Despite its widespread use, the questionnaire does not provide a reliable multidirectional assessment of psycho-emotional status. It may provide broad insight into potential psychological disturbances in chronic TMD, such as mood disorders, anxiety disorders and psychosocial disability. However, it does not offer guidance on further psychological, psychotherapeutic and/or medical support. Wieckiewicz et al. emphasized the importance of psycho-emotional factors, such as stress, fatigue, anxiety, depression, sleep disorders, and the fast pace of life, which have a significant negative impact on the human psyche and the progression of TMD.[8]

The aims of the preliminary investigation were:

1) to develop an initial questionnaire for the emotional assessment of patients with TMD and provide guidance for further management, including specialized psychological and/or psychiatric consultation;
2) to compare the results of tests carried out on TMD patients with those of healthy subjects without masticatory dysfunction symptoms.

The primary goal of the project was to create a universal questionnaire for the initial evaluation of the psycho-emotional state of TMD patients that would be available to all dentists as an alternative to numerous assessment scales, such as the Beck Anxiety Inventory (BAI), the Perceived Stress Scale (PSS), the Patient Health Questionnaire-9 (PHQ-9), the Symptom Checklist 90-Revised (SCL-90-R), the State-Trait Anxiety Inventory (STAI), and the Lazarus–Folkman Ways of Coping Questionnaire.[4,19] The questionnaire is only intended as a preliminary assessment of the psycho-emotional state to guide the dentist's further management of psychotherapeutic support for TMD patients. It refers to broad emotions such as lowered mood, anxiety, introversion, current mental well-being, sudden panic attacks, and self-dissatisfaction.

Material and methods

The study involved 260 patients who reported for dental treatment at the Prosthodontics Clinic of the Institute of Dentistry at Jagiellonian University in Krakow, Poland, and the Prosthodontic Cilnic at Medical University of Warsaw, Poland, between October 2021 and October 2023. Permission to conduct the study using our self-developed questionnaire was granted by the Bioethics Committee of Jagiellonian University (consent No. 1072.6120.312.2021 – 15.12.2021; clinical trial No. 1072.6120.312.2021 – 15.12.2021; ID NCT06041633). The population consisted of both men and women, with a female predominance, aged between 20 and 43 years. The study group (Group 1) consisted of 130 patients diagnosed with TMD, whereas the control group (Group 2) consisted of 130 patients who were excluded from having TMD (confirmed or excluded using the RDC/TMD questionnaire). The prosthetic treatment of patients in Group 2 was necessary to replace single missing teeth.

The inclusion criteria for the study were:

1) good general health, with no craniofacial trauma in the last 5 years and no severe mental health conditions;
2) the presence of TMD symptoms (pain in the masticatory muscles, limitation of the mouth opening range, and clicking or popping in the temporomandibular joints); these symptoms were not present in Group 2;
3) the patient's consent to participate in the research project.

The exclusion criteria for the study were:

1) willingness to withdraw from the study;
2) the presence of general medical conditions that made it impossible to continue participation in the study.

The questionnaire included 30 questions related to the respondent's emotional state over the past 4 weeks, such as lowered mood, emotional irritability, feelings of sadness, lack of desire for daily activities, lack of concentration, a desire for self-isolation, critical thoughts toward oneself, nervousness, or anxiety. Responses to each question included: no, several times in the last 4 weeks, several times per week, several times a day, and constantly/continuously. The results of the questionnaire were divided into sections A, B, C, and D, with scores ranging from 0 (most favorable response) to 4 (most unfavorable response) for each question.

During the initial stage of questionnaire development, it was evaluated for the appropriateness of the questions (special questionnaire). This evaluation was carried out by 4 dentists and 4 psychologists who were invited to cooperate, all of whom provided positive feedback. The survey was linguistically adapted by first being translated from Polish to English by a sworn translator, and then translated back into Polish by a person of British origin who is well-versed in Polish and works in Poland. Upon comparison of the 2 versions, differences were found in the wording of memory disorders.

The results of the questionnaire were compiled as follows:

– section A (0–30 points): good psycho-emotional state, possible individual difficulties with negative emotions;
– section B (31–60 points): mild psycho-emotional difficulties, symptoms indicating the experience of a small degree of emotional difficulties on a daily basis that do not cause discomfort to the patient but require monitoring, with a repeat examination indicated in about a few months;
– section C (61–90 points): moderate psycho-emotional difficulties that may cause discomfort to the patient if they increase in severity or persist (more than 3 months). Specialized help is recommended through psychoeducation and psychological and psychotherapeutic counseling;
– section D (91–120 points): exacerbated psycho-emotional difficulties that are frequent or continuous in nature. Psychiatric consultation and psychotherapeutic support are indicated.

Statistical analysis

Statistical analysis employed the IBM SPSS Statistics for Windows software, v. 29.0 (IBM Corp., Armonk, USA). The normality of data distribution was assessed using the Shapiro–Wilk test, and descriptive statistics, including mean (*M*) and standard deviation (*SD*), were calculated. Since the data was not normally distributed, differences between clinical cases and the control group were compared using the non-parametric Mann–Whitney U test. The χ^2 test verified any relationship between the categories (with points' partitions) between the 2 groups. The differences were considered significant for $p < 0.05$.[20]

A normality test determines whether the sample data was drawn from a normally distributed population. The Kolmogorov–Smirnov and Shapiro–Wilk tests are commonly used to test data normality. Since the data was not normally distributed, non-parametric tests were used (Mann–Whitney U test and χ^2 test).

The Mann–Whitney U test was implemented in SPSS software to test the null hypothesis that there are no statistically significant differences between the scores of 2 population groups. This function takes 2 data samples as parameters, uses the median (*Me*) as a measure of central tendency, and returns the test results with a *p*-value to indicate statistical significance. A significance level of $p < 0.05$ was used for all analyses, as it is commonly used in biomedical research.

The χ^2 test was utilized as a statistical tool to assess whether 2 categorical variables were related or independent and to determine if the observed data significantly differed from the expected data. By comparing the 2 datasets, we can draw conclusions about whether the variables have a meaningful association. Additionally, sensitivity and specificity analyses were conducted.

Sensitivity and specificity are statistical measures commonly used in diagnostic and classification tasks to evaluate the performance of a statistical test or model. They are used to distinguish between 2 groups, such as control and clinical/study groups. In the context of questionnaire data, sensitivity and specificity can help assess how well the questionnaire can identify individuals in the clinical group while minimizing false positive cases in the control group. Receiver operating characteristic (ROC) analysis was used for these calculations.

Bias

A potential source of error in a survey is the provision of false answers, which may occur due to the inclusion of personal information, such as the respondent's name, or the presence of sensitive questions, such as those related to suicidal thoughts or the use of alcohol and other psychoactive substances.

Results

The results showed that Group 1 (TMD patients) had a significantly higher percentage of responses that were graded as B (90 patients/69.2%) and C (10 patients/7.7%) compared to Group 2 (controls). In Group 1, 29 patients (22.3%) scored an A and 1 individual scored a D (0.8%).

In Group 2, 101 individuals (77.7%) scored an A, 28 patients (21.5%) scored a B, 1 patient scored a C, and there were no scores of D. These results show significantly more scores of B in Group 1 and A in Group 2. The results are collated in Tables 1–3 and Fig. 1.

The mean score obtained in Group 1 was 37.715 points (median (*Me*) = 35.5, standard deviation (*SD*) = 12.58), while Group 2 had a mean score of 24.938 points (*Me* = 24, *SD* = 7.95) ($p < 0.001$). Most respondents in Group 1 received a score of 40 (diagnosis B), while most respondents in Group 2 scored 20, which is within the range of scores for individuals without psycho-emotional disorders.

Upon analyzing the resulting diagnoses (A, B, C, and D) and the need for psychological or psychiatric support, significant differences were found in diagnoses A, B and C between Group 1 and Group 2, while the results for D did not differ. These findings suggest the importance of simultaneous diagnosis of TMD and evaluation of the patient's psycho-emotional status due to the significant contribution of this factor to the etiology of TMD. The results of the RDC/TMD diagnosis within Group 1 are presented in Table 4 and Fig. 2.

The ROC curve analysis was performed to determine the cut-off point for the questionnaire scores. On this basis, the entire model was analyzed and found to be of good quality (Table 5) (Fig. 3). Based on the Youden index (0.554) and the Gini index (0.684) as classifier evaluation metrics, a cut-off point of 29.5 was established for the questionnaire. The sensitivity and specificity values for the cut-off point were both 0.777, indicating that 78% (n = 101) of the cases were correctly classified into the study group. Therefore, those who scored 29.5 points and

Table 1. Descriptive statistics of the developed questionnaire scores for Groups 1 and 2

Variable		Group 1		Group 2	
		Statistic	*SE*	Statistic	*SE*
M		37.72	1.104	24.94	0.697
95% *CI* for *M*	lower bound	35.53	–	23.56	–
	upper bound	39.90	–	26.32	–
5% trimmed mean		36.81	–	24.54	–
Me		35.50	–	24.00	–
Variance		158.329	–	63.190	–
SD		12.583	–	7.949	–
Minimum		17	–	10	–
Maximum		92	–	68	–
Range		75	–	58	–
IQR		8	–	10	–
Skewness		1.493	0.212	1.532	0.212
Kurtosis		3.245	0.422	6.006	0.422

Group 1 – patients with temporomandibular disorders (TMD); Group 2 – control group; *M* – mean; *CI* – confidence interval; *Me* – median; *SD* – standard deviation; *IQR* – interquartile range; *SE* – standard error.

Table 3. Distribution of questionnaire sections established as identification of psycho-emotional or psychiatric support needs in Groups 1 and 2

Classification	Group 1	Group 2	Total
Section A	29 (22.3)	101 (77.7)	130 (50)
Section B	90 (69.2)	28 (21.5)	118 (45.4)
Section C	10 (7.7)	1 (0.8)	11 (4.2)
Section D	1 (0.8)	0 (0.0)	1 (0.4)
Total	130 (100.0)	130 (100.0)	260 (100.0)

Data presented as number (percentage) (*n* (%)). There are significant differences between the groups in sections A, B and C.

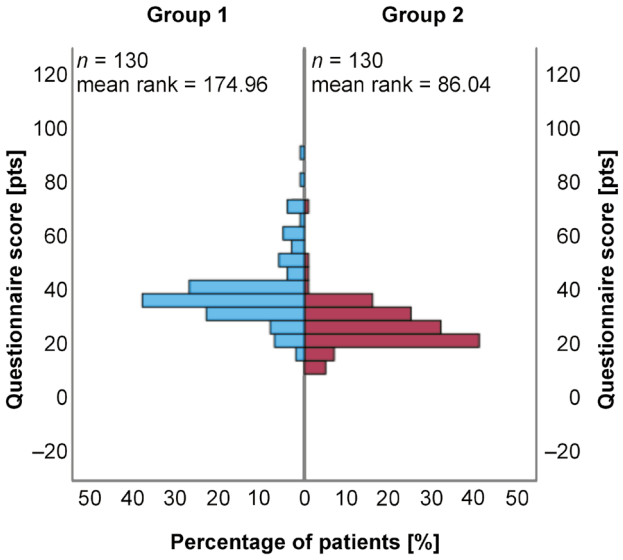

Fig. 1. Frequency of questionnaire scores in Groups 1 and 2

Group 1 – patients with temporomandibular disorders (TMD); Group 2 – control group. Independent-samples Mann–Whitney U test was used.

Table 2. Statistical analysis of mean questionnaire scores in Groups 1 and 2

Group	Patients, *n*	*M*	*Me*	Minimum	Maximum	*SD*	*p*-value
Group 1	130	37.715	35.500	17.000	92.000	12.580	<0.001*
Group 2	130	24.938	24.000	10.000	68.000	7.950	

* statistically significant (Mann–Whitney U test).

higher on the questionnaire were more likely to be classified into the study group than those who obtained lower results.

Table 4. Statistical analysis of the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) diagnosis results in Group 1

Variable	Result
Patients, *n*	130
Test statistic	5.053
df	5
Asymptotic significance (two-sided test)	0.409

df – degrees of freedom.

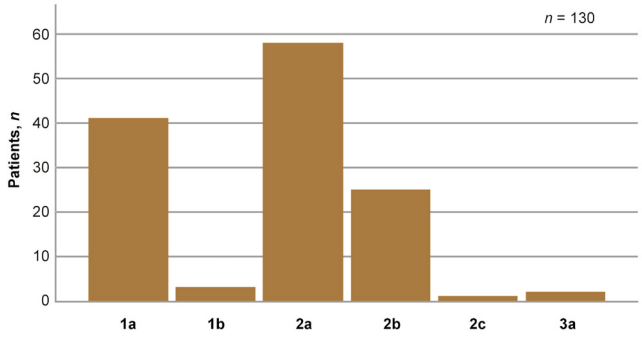

Fig. 2. Distribution of TMD forms diagnosed using the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) questionnaire in Group 1

1a – myofascial pain; 1b – myofascial pain with limited opening; 2a – disc displacement with reduction; 2b – disc displacement without reduction with limited opening; 2c – disc displacement without reduction, without limited opening; 3a – arthralgia.

Table 5. Analysis of the area under the receiver operating characteristic (ROC) curve

Area	*SE*	Asymptotic significance	Asymptotic 95% *CI*	
			lower bound	upper bound
0.842	0.025	0.000	0.793	0.891

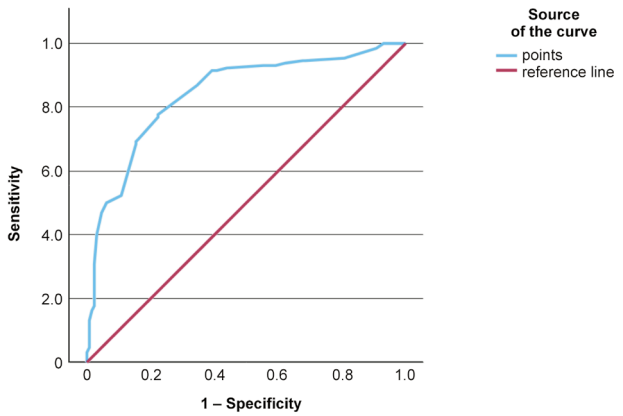

Fig. 3. Receiver operating characteristic (ROC) curve analysis for sensitivity and specificity of study groups

More individuals in Group 1 scored 29.5 points or higher compared to Group 2, and more individuals in Group 2 scored less than 29.5 points compared to Group 1. This difference was found to be statistically significant using the χ^2 test and Fisher's exact test (Table 6).

Table 6. Comparison of classification results based on statistical variables between Groups 1 and 2

Variable	χ^2 test		
	value	*df*	*p*-value
Pearson's χ^2	79.754	1	<0.001*
Continuity correction	77.554	1	<0.001*
Likelihood ratio	84.434	1	<0.001*
Fisher's exact test	–	–	<0.001*
Linear-by-linear association	79.447	1	<0.001*
Valid cases, *n*	260	–	–

* statistically significant.

Discussion

The results of the current study suggest that the developed questionnaire is useful for the initial assessment of the psycho-emotional state of TMD patients. The information obtained, in accordance with established indications for further psychological or psychiatric consultation, can be an invaluable addition to the diagnosis of TMD patients and may constitute a critical element for effective treatment of the disorder. The results are significant and suggest that patients with TMD suffer from psycho-emotional problems and require more frequent consultation and psychological support than healthy individuals.

Given the numerous reports in the literature linking the psycho-emotional disorders with TMD development,[1,2,5,6,8,12,16,18,21–25] it is important to consider the patient's condition during specialized diagnosis of this disease. In recent years, emotional state assessment has become even more important due to the significant stress and emotional strain experienced by a significant portion of the population as a result of coronavirus disease 2019 (COVID-19), including the death of loved ones and concern for their lives.[19]

In their cross-sectional analysis of Swedish national registries, Fredricson et al. demonstrated a strong association between the occurrence of mental and behavioral disorders (MBD) and TMD. Pain, the most common symptom of TMD, was strongly associated with depression, anxiety and stress-related disorders, which are modified in TMD.[9] A prospective cohort study by Fillingim et al. identified several psychological variables as premorbid risk factors for initial TMD onset.[3] Meanwhile, Sójka et al.[4] and others[22–25] highlighted that comorbidity factors associated with TMD development include psychological stress, anxiety, emotional tension, and structural and parafunctional habits.

Several studies emphasize the importance of standardizing the assessment of psycho-emotional state performed by dentists and developing tools to refer patients for specialized consultation in the area of psycho-emotional disorders.[21–28]

If psycho-emotional disorders are believed to significantly contribute to TMD development, it is critical to diagnose them at the outset and to provide parallel support or psychiatric treatment within the TMD unit.[29,30] Seweryn et at. noted a correlation between the intensity of pain associated with TMD and the quality of life and sleep. These parameters were found to be influential in modifying TMD management.[31] Furthermore, Topaloglu-Ak et al. evaluated the relationship between sleep habits and TMD, bruxism and caries in children, revealing their potential negative impact on children's sleep habits and characteristics.[32]

A dentist's preliminary diagnosis should complement the specialized diagnosis of TMD and indicate further possible solutions. According to Yadav et al., stress is an important factor that is closely associated with problematic behaviors such as bruxism. Moreover, the authors found a significant correlation between this parafunctional activity and a higher degree of TMD symptoms.[18]

In view of the above, it is crucial to consider the necessity of psychological and/or psychiatric support in the course of TMD treatment.

Additionally, Martynowicz et al. emphasized that rhythmic masticatory muscle activity (RMMA) is a periodic muscle activity that characterizes sleep bruxism events. It can occur as a single event, in pairs or in clusters, and is connected with the severity of orofacial pain.[33]

During the implementation of the present project, the research results facilitated the decision on the indicated psychological or psychiatric consultation for patients treated for TMD. Moreover, the patients expressed their satisfaction with the recommendation of a necessary consultation regarding their psycho-emotional state.

The results of the study suggest that the developed questionnaire can be used as a supplement to the specialized examination for TMD diagnosis. In addition, it can assist dentists in identifying potential psycho-emotional issues in patients and recommending further therapeutic management.

Limitations

Since this is a preliminary report, validation of the questionnaire was not carried out. However, it is planned for the next stages of the project.

Conclusions

This research indicates that the developed questionnaire was significantly useful for conducting an initial assessment of the psycho-emotional state of patients during TMD diagnosis. Furthermore, the results highlight a greater need for psychological counseling in patients with TMD compared to healthy individuals.

Ethics approval and consent to participate

The study was approved by the Bioethics Committee of Jagiellonian University (consent No. 1072.6120.312.2021 – 15.12.2021; clinical trial No. 1072.6120.312.2021 – 15.12.2021; ID NCT06041633). Patients provided consent to participate in the research project.

Data availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Consent for publication

Not applicable.

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