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Psychological distress and well-being: their association with temporomandibular disorder symptoms

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ABSTRACT

Objective: This study investigated the associations between temporomandibular disorder (TMD) symptoms, psychological distress, and well-being.

Methods: A total of 372 university students were recruited and stratified into no TMD, TMD pain, TMJ sounds, and combined TMD groups. Psychological distress and well-being were assessed with the Depression, Anxiety, and Stress Scale-21 (DASS-21) and Scales of Psychological Well-being-18 (SPWB-18), respectively. Data were appraised with Kruskal-Wallis/Mann-Whitney U tests and logistic regression analysis ($\alpha = 0.05$)

Results: Significant differences in anxiety, stress, and autonomy scores were observed among the four groups, and psychological distress was mostly negatively correlated to psychological well-being. Multivariate analyses revealed that anxiety was associated with TMD pain, TMJ sounds, and combined TMD, while autonomy was related to TMJ sounds.

Conclusion: Participants with TMD symptoms generally experienced more psychological distress and lower autonomy. Anxiety appeared to increase the likelihood of TMD pain and/or TMJ sounds.

KEYWORDS
Temporomandibular disorders; depression; anxiety; stress; psychological well-being

Introduction

Temporomandibular disorders (TMDs) is a collective term describing an array of conditions affecting the masticatory muscles, temporomandibular joints (TMJs), and/or surrounding tissues [1]. Painful TMDs are a public health concern, as they are one of the most common chronic pain conditions that prompt people to seek care, thereby increasing community healthcare burdens [1,2]. Non-painful TMDs, primarily TMJ disc displacements, may not cause pain or major discomfort. However, they may progress to TMJ closed lock and degenerative joint disease (DJD) in some cases [3]. Both TMJ disc displacements and DJD are typically associated with TMJ sounds, namely clicking and crepitus, respectively.

Psychological distress, including depression, anxiety, and stress, has been linked to TMD signs and symptoms and influences TMD treatment prognosis [4]. The association of negative psychological symptoms with TMDs escalates with increasing age in children through adolescence, and they are a predictor of TMD pain onset in adolescents [5]. The incorporation of biopsychosocial factors into the diagnosis and management of TMDs was first formalized through the dual-axis Research Diagnostic Criteria for TMDs (RDC/TMD). This was superseded by the Diagnostic Criteria for TMDs (DC/TMD), which is the current benchmark for TMD diagnoses [6].

Although prior studies have focused mainly on psychological distress, there is a growing interest in the psychological well-being of patients [7]. Psychological well-being is an essential factor for better health [8] and refers to inter-and intra-individual levels of positive functioning that include one's relatedness with others and self-referent attitudes [7]. It approaches psychological issues from the response of the individual. As an individual with low well-being cannot function in the optimal range, quality of life may be negatively impacted [8]. To date, no study has been conducted on the association between psychological well-being and TMD complaints. This may be clinically relevant, considering the number of longitudinal studies confirming the ability of psychological well-being scales to predict physical health, quality of life, social behaviors, alcohol and drug use, and longevity [9]. Therefore, the objectives of this study were to examine the associations between psychological distress/well-being and TMD symptoms and to establish the relationship between psychological distress

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and well-being in subjects with no and different TMD complaints. The null hypotheses were as follows: (a) depression, anxiety, and stress are not associated with TMD complaints, (b) psychological well-being is not related to TMD symptoms, and (c) psychological distress and well-being are not correlated.

Materials and methods

Study participants

This study was approved by the ethics committee of Trisakti University School of Dentistry, Indonesia (reference no: 244/S3/KEPK/FKG/2/2019). Students from a local University in the capital city of Jakarta were recruited for the study. Based on a TMD prevalence of 25% [5], 95% confidence level, 5% margin of error and student enrollment of 8000, a minimum sample size of 279 subjects was confirmed with a sample size calculator (https://www.calculator.net/sample-size-calculator.html). The inclusion criteria were the following: (a) aged 18–22 years at recruitment, and (b) good general health (i.e., no injury, impairment, or acute/chronic debilitating illness at recruitment). Subjects who were physically and/or mentally challenged and those who declined participation were excluded from the study. Contribution to the study was completely voluntary, and informed consent was obtained before administering the electronic survey.

The electronic survey was conducted over a month using Google Forms (http://www.google.com/forms) and was comprised of socio-demographic information, the Indonesian version of the DC/TMD Symptom Questionnaire (SQ), the Depression, Anxiety, and Stress Scale-21 (DASS-21), and the Scales of Psychological Well-being-18 (SPWB-18) [10–12].

Measures

The DC/TMD SQ comprises 14 items concerning TMD pain, headaches, TMJ sounds, and closed and open locking of the TMJs. A positive response to the questions, "Have you ever had pain in your jaw, temple, in the ear, or in front of the ear on either side?" and, "In the past 30 days, have you ever had any jaw joint noise(s) when you moved or used your jaws?" was used to indicate the presence of TMD pain and TMJ sounds, respectively. The subjects were subsequently stratified into the following four groups: no TMD complaints (NT), TMD pain (TP), TMJ sounds (TS), and combined TMD complaints (CT), i.e., TMD pain plus TMJ sounds.

The DASS-21 consists of 21 items, with seven questions assigned to each psychological state (i.e., depression, anxiety, and stress). The questions are scored on a 4-point response scale, with 0 = did not apply to me at all to 3 = applied to me very much, or most of the time. The total sum-score for each psychological state is calculated, with higher scores indicating more severe symptoms. The cut-off points for the various severity categories, namely normal to extremely severe, are described in the DASS manual [13]. The SPWB-18 involves 18 items, with three questions dedicated to each of the six aspects of well-being, namely autonomy, environmental mastery, personal growth, positive relationships with others, purpose in life, and self-acceptance. The questions are scored on a 7-point response scale with 1 = strongly agree to 7 = strongly disagree. The subscale scores are added together to give the total SPWB score. Greater total and subscale scores indicate higher levels of psychological well-being [11].

Statistical analysis

Statistical analyses of the DASS-21 and SPWB-18 data were carried out using the IBM SPSS Statistics for Windows software version 24.0 (IBM Corporation, Armonk, NY, USA), with the significance level set at 0.05. Data distribution was examined using the Kolmogorov-Smirnov test. Non-parametric methods were employed, as data were not normally distributed. Domain and subscale scores for both psychological distress and well-being were compared between subjects with no TMDs, TMD pain, and/or TMJ sounds using the Kruskal-Wallis and Mann-Whitney U post hoc tests. The inter-relationship between depression, anxiety, stress, and total PSWB scores was determined for the various TMD groups with the Spearman correlation test (p <0.05).

Univariate and multivariate logistic regression analyses were also performed to assess how the psychological variables, both distress and well-being, associate to each of the TMD complaint groups. Therefore, data were divided, based on the TMD complaint group. When the relation or dependency between the psychological predictors and each TMD complaint was strong enough (*p-value* <0.10), this predictor was incorporated into a multivariate logistic regression model. Predictors with the weakest association with the TMD complaint were removed using the backward stepwise approach. All predictors in the final model had a p-value <0.05.

Results

A total of 500 students were invited to participate in the study, of whom 372 met the inclusion criteria and consented to participate (response rate of 74.4%). The study cohort comprised 302 women and 70 men with a mean

age of 19.9 ± 2.1 years. Of the 372 subjects, 52.7% (n = 195) had no TMD complaints, while 47.5% (n = 177) reported TMD pain and/or TMJ sounds. The prevalence of TMD pain, TMJ sounds, and combined TMD complaints were 14.5% (n = 54), 17.7% (n = 66), and 15.3% (n = 57), respectively.

The mean (± standard deviations) and medians (interquartile range) DASS-21 and SPWB-18 scores for the four TMD groups are presented in Table 1. Significant differences in anxiety ($p < 0.001$), stress ($p = 0.010$), and autonomy ($p < 0.001$) scores were observed among the four groups. Post-hoc analyses indicated the following significant differences in psychological distress/well-being scores:

- anxiety – TMJ pain, TMJ sounds, and combined TMD are higher than the no TMD group;
- stress – TMD pain and combined TMD are higher than the no TMD group;
- autonomy – No TMD is higher than TMJ pain, TMJ sounds, or combined TMD group.

No significant difference was observed for any of the variables between the TMD pain, TMJ sounds, and combined TMD groups. Spearman's test indicated significant negative correlations between depression, anxiety, stress, and total SPWB scores (Table 2). The relation was weakest in the No TMD group and the strongest in the TMD pain group with correlation coefficient (r_s) ranging from –0.63 to –0.74. Table 3 displays the results of univariate and multivariate regression analyses. Univariate regression analyses indicated that anxiety and stress were associated with TMD pain and combined TMD, while only anxiety was related to TMJ sounds. Different SPWB subscales were associated with the various TMD complaints, namely environmental mastery for TMD pain, autonomy for TMJ sounds, autonomy, purpose in life, and total SPWB score for Combined TMD. Multivariate analyses revealed that anxiety was associated with TMD pain, TMJ sounds, and Combined TMD, while autonomy was related to TMJ sounds.

Discussion

Overview and TMD symptoms

The associations between psychological distress/well-being and TMD complaints, as well as the inter-relationships between psychological distress and well-being, were determined in this study. To the authors' knowledge, this is the first study to investigate the psychological well-being of subjects with TMD symptoms. As psychological distress

Table 1. Mean and median scores of the various TMD groups.

Variables		(1) No TMD (n = 195)		(2) TMD Pain (n = 54)		(3) TMJ Sounds (n = 66)		(4) Combined TMD (n = 57)		p value	Post Hoc analysis (1–2)
		Mean ± SD	Median (IQR)	Mean ± SD	Median (IQR)	Mean ± SD	Median (IQR)	Mean ± SD	Median (IQR)		
Psychological distress	Depression	4.29 ± 3.45	4 (2–6)	5.20 ± 3.86	4 (2–8)	4.42 ± 3.55	4 (2–5.25)	5.23 ± 3.53	5 (5–11)	0.138	
	Anxiety	5.58 ± 3.31	5 (3–8)	8.06 ± 3.95	7 (5–10)	6.70 ± 3.41	7 (4–9)	7.93 ± 3.80	7 (5–11)	< 0.001*	2,3,4 > 1
	Stress	7.08 ± 3.71	7 (4–10)	8.85 ± 4.31	8 (6–11)	7.94 ± 4.45	7.5 (5–11)	8.88 ± 4.33	9 (6–12)	0.027*	2,4 > 1
Psychological well-being	Autonomy	11.78 ± 1.96	12 (10–13)	11.19 ± 2.22	11 (10–12.25)	11.14 ± 1.85	11 (10–12)	11.07 ± 1.82	11 (10–12)	0.011*	1 > 2,3,4
	Environmental mastery	14.33 ± 2.68	14 (12–16)	12.80 ± 3.94	14 (10–16)	14.08 ± 2.69	14 (12–16)	13.89 ± 2.58	14 (12–16)	0.095	
	Personal growth	17.84 ± 2.39	18 (17–19)	17.63 ± 2.57	18 (16–20)	18.23 ± 1.99	19 (17–20)	17.37 ± 2.63	18 (16–19)	0.443	
	Positive Relations with others	14.30 ± 3.11	15 (12–17)	14.07 ± 3.28	14 (12–17)	14.14 ± 3.02	14 (12.75–16)	13.70 ± 3.06	14 (11.50–16)	0.520	
	Purpose in life	15.16 ± 2.86	16 (14–17)	15.31 ± 2.64	15 (14–17)	15.29 ± 2.39	15 (14–17)	14.30 ± 2.56	15 (13–16)	0.094	
	Self- acceptance	15.19 ± 3.03	16 (13–18)	14.46 ± 3.24	15 (12–17)	14.86 ± 3.45	16 (12–17)	14.28 ± 3.17	14 (12–17)	0.136	
	Total SPWB	88.62 ± 10.70	90 (83–96)	85.87 ± 12.30	87 (76.75–94.50)	87.73 ± 10.00	89 (81.75–94.25)	84.61 ± 10.54	86 (74.50–92)	0.055	

*Indicates significant variables analyzed with Kruskal-Wallis test ($p < 0.05$). **Indicates significant post-hoc comparison between groups with Mann-Whitney analysis ($p < 0.05$). TMD: Temporomandibular disorder; SPWB: Scales of psychological well-being.

Table 2. Correlations between total psychological well-being and psychological distress scores for the different temporomandibular disorder (TMD) groups.

		Depression	Anxiety	Stress
Total Psychological well-being	No TMD	−0.63	−0.30	−0.42
	TMD pain	−0.74	−0.71	−0.63
	TMJ sounds	−0.59	−0.36	−0.41
	Combined TMD	−0.71	−0.50	−0.60

All correlations are significant as analyzed with Spearman correlation test ($p < 0.05$).
TMJ: Temporomandibular joint.

and well-being were related to TMD complaints and interrelated, all three null hypotheses were disregarded.

The questions used to screen for TMD pain and TMJ sounds were key items of the DC/TMD, which has high reliability and validity [14]. As clinical and diagnostic imaging was not performed, definitive diagnoses of myalgia (muscle pain), arthralgia (TMJ pain), and disc displacements could not be ascertained. Among the five TMD symptoms of the DC/TMD SQ, TP and TS were selected considering the substantially higher prevalence of TMD-related myalgia and TMJ disc displacements in the general population [15]. The DASS-21 and SPWB-18 are both short versions of their original measures, namely the DASS-42 and SPWB-42. The psychometric properties of the two measures had been established, and they are widely used in research [16]. The frequency of TMD complaints in the cohort of Indonesian young adults (47.6%) was substantially lower than that of Chinese youths (61.4%) [17]. Besides racial and ethnic differences, the exclusion of TMJ closed/open-lock and headaches could have contributed to the variance observed. Headaches, in particular, are very common in the general population and a symptom of many other health conditions. Prevalence rates for TMD pain in Indonesian children and adolescents were 23.4% and 36.9%, respectively [5]. The prevalence of TMD pain

Table 3. Univariate and multivariate logistic regression analyses to determine associated factors for TMD pain, TMJ sounds, and combined TMD. Associations are expressed as odds ratio (OR), with no TMD group as the reference group and 95% confidence interval (CI).

	Single regression model			Multiple regression model (n = 249)		
Variable	OR	95% CI	*p* value	OR	95% CI	*p* value
Distress						
Depression	1.07	0.99–1.16	0.099			
Anxiety	1.21	1.11–1.32	< 0.001*	1.17	1.07–1.29	0.001*
Stress	1.12	1.04–1.21	0.004*			
Well being						
Autonomy	0.86	0.74–1.00	0.057			
Environmental mastery	0.86	0.78–0.94	0.002*			
Personal growth	0.97	0.86–1.09	0.572			
Positive relations with others	0.98	0.89–1.08	0.636			
Purpose in life	1.02	0.92–1.14	0.728			
Self-acceptance	0.93	0.84–1.02	0.125			
Total SPWB score	0.98	0.95–1.01	0.112			
TMJ SOUNDS						
Distress						
Depression	1.01	0.93–1.01	0.789			
Anxiety	1.10	1.02–1.20	0.021*	1.09	1.00–1.19	0.040*
Stress	1.06	0.99–1.13	0.126			
Well being						
Autonomy	0.84	0.72–0.97	0.021*	0.85	0.73–0.99	0.036*
Environmental mastery	0.97	0.87–1.07	0.508			
Personal growth	1.08	0.95–1.24	0.239			
Positive relations with others	0.98	0.90–1.08	0.705			
Purpose in life	1.02	0.92–1.13	0.752			
Self-acceptance	0.97	0.89–1.06	0.459			
Total SPWB score	0.99	0.97–1.02	0.553			
COMBINED TMD						
Distress						
Depression	1.08	0.99–1.17	0.078			
Anxiety	1.20	1.10–1.31	< 0.001*	1.19	1.09–1.30	< 0.001*
Stress	1.12	1.04–1.21	0.003*			
Well being						
Autonomy	0.82	0.70–0.96	0.016*			
Environmental mastery	0.94	0.84–1.05	0.279			
Personal growth	0.93	0.83–1.04	0.204			
Positive relations with others	0.94	0.86–1.03	0.200			
Purpose in life	0.90	0.81–1.00	0.044*			
Self-acceptance	0.91	0.93–1.00	0.051			

TMD: Temporomandibular disorder; TMJ: Temporomandibular joint; SPWB: Scales of psychological well-being.

(29.84%) in the current cohort of Indonesian University students was comparable.

Psychological distress

Psychological distress is a recognized risk factor for TMDs. Youths with TMDs were found to have higher levels of psychological distress, specifically anxiety [17,18]. This was corroborated by the present study, where multivariate logistic regression indicated that anxiety increased the odds of TMD pain and/or TMJ sounds. Findings were also consistent with those of Monteiro et al. [19], who reported that trait-anxiety, which assesses how students feel, was strongly correlated to TMD complaints in Brazilian University students. However, no association was noted between state-anxiety that observed students' reactions to adverse situations and TMDs. Hence, anxiety traits might heighten an individual's attention to symptoms or irregularities, amplifying their perceived intensity. The aforementioned may be further compounded by the tendency of Asians to somatize psychological distress compared to Westerners [20]. Repetitive oral habits, including awake and sleep bruxism, probably serve as the link between anxiety and TMD pain as well as TMJ sounds (due to TMJ disc displacements or DJD) [21].

Contrary to the findings of this study, other researchers have reported that depression, not anxiety, was the strongest psychological predictor for pain-related TMD and disability [22]. The distinctions can be attributed to the differences in study populations and TMD severity. While the current work involved "non-patient" youths, where TMD symptoms may not be serious, the latter studies involved patients seeking active management for TMDs. Furthermore, the duration of TMD can also influence the type of psychological disturbance with pain chronicity being associated with depression [23]. In the present study, no significant difference in psychological distress was observed among the TMD pain, TMJ sounds, and Combined TMD groups. Another study had indicated that subjects with TMD pain generally have higher levels of psychological distress than those with TMJ problems [24]. However, this study was also carried out on TMD patients instead of youths in the general population.

Psychological well-being

Ryff's SPWB defines a person's ability to fully function in life, regardless of happiness or feeling good [25]. Although various SPWB subscales were associated with different TMD complaints, only autonomy was related to TMJ sounds with the multivariate regression modeling. TMJ sounds can arise from TMJ disc displacements or DJD. While generally self-limiting, some cases do progress to TMJ pain, trismus, and functional disabilities. The autonomy subscale of the SPWB specifies an individual's confidence in his/her opinions and ability to regulate his/her behavior independent of social pressure [7,11]. Though the exact connection between TMJ sounds and autonomy is not known, it may be mediated by oral parafunctions and their associated psychological distress, given the moderately strong correlation between psychological distress and well-being in the TMJ sounds group [21]. Concerning healthcare, autonomy is related to how motivated individuals are to seek health treatment [26]. The chronicity of health conditions is, thus, reduced. In adolescents and young adults, this positive psychological trait may be somewhat unstable since they are likely to experience conflicts between their independent needs and restraints from their adult guardians [27]. Moreover, autonomy is generally lower in young Asians when compared to their Western counterparts [28]. It is, thus, plausible that the youths with TMJ sounds are troubled by their functional disorders but are not sufficiently motivated to seek care until symptoms are debilitating.

Psychological well-being was negatively correlated to psychological distress, with depression showing the strongest associations for all groups (r_s = −0.59 to −0.74). Strong negative correlations were also noted between psychological well-being and anxiety for the TMD pain group (r_s = −0.71). Findings were in agreement with others regarding the relationship between depression/anxiety and well-being in Asian youths. Liu et al. [16], in their study of Japanese University students, concluded that depression and anxiety are somewhat determined by the lack of psychological well-being. As interventional therapies targeted at enhancing psychological well-being were shown to improve pain and depression symptoms, further studies on psychological well-being and TMDs are warranted [29].

Study limitations

Although the present study has yielded some new insights on the psychological distress and well-being in young adults with TMD complaints, it has several limitations. The study involved a cross-sectional design that does not permit causal or temporal relationships to be established between psychological distress/well-being and TMD symptoms. Furthermore, the complaints of TMD pain and/or TMJ sounds were self-reported by subjects and were not verified by clinical examinations.

Therefore, outcomes may be subjected to reporting and other biases. An extended study involving more study subjects (preferably from different socio-economic and educational backgrounds) and the inclusion of headaches as well as TMJ closed/open lock symptoms should be considered. The impact of psychological well-being on oral health-related quality of life should be addressed, given the negative impact of orofacial pain on the latter [30].

Although joint sounds were associated with increased anxiety and decreased autonomy, the type of TMJ noises, specifically TMJ clicking and crepitus, were not distinguished in this study. While TMJ clicking is related to disc displacements, TMJ crepitus is linked to TMJ degenerative joint disease. Although the two conditions have different etiopathophysiology and prognosis, they often co-exist and are inter-related. Furthermore, it is challenging for clinicians, let alone participants, to detect and characterize joint sounds [31,32]. Further exploration on the association of intra-articular TMJ conditions with psychological distress and well-being involving adjunctive diagnostic imaging is, thus, worth pursuing.

Stepwise regression analysis was used to establish the risk factors for TMD pain and/or TMJ sounds. Even though it showed that anxiety was associated with TMD pain and autonomy to TMJ sounds, the results should be interpreted cautiously due to possible bias in parameter estimation, leading to inappropriate reliance on a single best model related to this statistical method.

The study utilized the Indonesian language versions of the DASS-21 and SPWB-18. While the Indonesian DASS-21 utilized is the official Indonesian adaptation of the instrument (http://www2.psy.unsw.edu.au/dass/), no formal Indonesian version of the SPWB-18 is currently available. The Indonesian version of the SPWB-18 and DC/TMD SQ was duly developed based on the INfORM (International Network for Orofacial Pain and Related Disorders Methodology) guidelines. The good criterion validity was evidenced by the mostly significant and moderate-to-strong correlations (albeit negative) between DASS-21 and SPWB-18. The Indonesian version of DC/TMD SQ is in the process of publication on the INfORM website.

Conclusion

This current study investigated the associations between psychological distress, psychological well-being, and TMD symptoms. About half of the youths (47.5%) assessed reported the presence of TMD pain and/or TMJ sounds. Subjects with TMD pain (with and without TMJ sounds) had significantly higher levels of anxiety and stress than those with no TMD complaints. Conversely, subjects with no TMD symptoms conveyed significantly greater autonomy than their counterparts with TMD complaints. Negative correlations between depression, anxiety, stress, and psychological well-being were observed, with the TMD pain group presenting the strongest relationships. Anxiety appeared to increase the odds of TMD pain and/or TMJ sounds, while autonomy was associated with TMJ sounds. As interventional therapies targeted at enhancing psychological well-being can improve pain and depression symptoms, additional work on psychological well-being and TMDs are advantageous.

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