BUKTI KORESPONDENSI

ARTIKEL JURNAL NASIONAL BEREPUTASI

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

Jurnal : CRANIO: THE JOURNAL OF CRANIOMANDIBULAR & SLEEP PRACTICE, 2024, Volume 42 | Issue 3 | 1 Mei 2024. DOI: https://doi.org/10.1080/08869634.2021.1971449

Penulis : Carolina Marpaung BDS, MDS, PhD, Adrian Ujin Yap BDS, MSc, PhD, Grad Dip Psychotherapy, Isya Hanin BDS, MDS, and Astrya Fitryanur BDS

No	Perihal	Tanggal
1	Bukti submit ke CRANIO	6 Februari 2021
2	Bukti konfirmasi review	24 Mei 2021
3	Bukti respon ke reviewer	6 Juli 2021
4	Bukti konfirmasi artikel diterima	18 Agustus 2021

01. Bukti Submit ke CRANIO

6 Februari 2021

UNIVERSITAS TRISAKTI

Carolina Marpaung <carolina@trisakti.ac.id>

Submission to CRANIO: The Journal of Craniomandibular & Sleep Practice

1 message

Editorial Office, CRANIO: The Journal of Craniomandibular & Sleep Practice <em@editorialmanager.com> Sat, Feb 6, 2021 at 10:54 PM
Reply-To: "Editorial Office, CRANIO: The Journal of Craniomandibular & Sleep Practice" <contact@cranio.com>
To: Carolina Marpaung <carolina@trisakti.ac.id>

CC: "Adrian Ujin Yap" aujyaprd@gmail.com, "Isya Hanin" isya.hanin@gmail.com, "Astrya Fitryanur" astryafn@gmail.com

Dear Dr Marpaung

We acknowledge receipt of your submission entitled "Psychological distress and well-being: Their association with Temporomandibular disorder symptoms and inter-relationships" to CRANIO: The Journal of Craniomandibular & Sleep Practice.

You will be able to check the progress of your paper by logging on to Editorial Manager as an author at the URL
https://www.editorialmanager.com/crn/:
Your username is: c.marpaung
https://www.editorialmanager.com/crn/l.asp?i=114419&l=2DNIX68D

Your manuscript reference number is ##CRN1407##. Please refer to this in any correspondence.

Thank you for submitting your work to this journal.

Kind regards,

CRANIO: The Journal of Craniomandibular & Sleep Practice

Manuscript Title: Psychological distress and well-being: Their association with Temporomandibular disorder symptoms..

Running Title: Psychological distress/well-being and TMDs.

Article Category: Original article

Authors: Carolina Marpaung, BDS, PhD.[1*], Adrian Ujin Yap, BDS, MSc, PhD, Grad Dip Psychotherapy [1-3], Isya Hanin, BDS, MDS[1], Astrya Fitryanur, BDS[1].

[1]Department of Prosthodontics, Faculty of Dentistry, Trisakti University, Indonesia.

[2]Department of Dentistry, Ng Teng Fong General Hospital and Faculty of Dentistry, National University Health System, Singapore.

[3]National Dental Research Institute Singapore, National Dental Centre Singapore and Duke-NUS Medical School, SingHealth, Singapore.

Correspondence:

Carolina Marpaung, BDS, PhD
Senior Lecturer, Department of Prosthodontics
Faculty of Dentistry, Trisakti University
Address: Jl Kyai Tapa no 260, Jakarta 1140, Indonesia
E-mail: carolina@trisakti.ac.id Tel: +6287808001055

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

Carolina Marpaung BDS, PhD[a], Adrian Ujin Yap BDS, MSc, PhD, Grad Dip Psychotherapy [a,b,c], Isya Hanin BDS, MDS[a] and Astrya Fitryanur BDS[a]

Correspondence to: Carolina Marpaung, Department of Prosthodontics, Faculty of Dentistry, Trisakti University, Jl Kyai Tapa no 260, Jakarta 1140, Indonesia
Email: carolina@trisakti.ac.id

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 had 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 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, on 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 derive 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 posthoc 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 and well-being were related to TMD complaints and inter-related, 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 (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 felt, 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.

Conflict of interest

The authors have no financial or personal conflict of interest to report relating to this article.

Funding

No funding was received for this study.

Acknowledgment

The authors would like to thank the Faculty of Dentistry, Trisakti University for supporting and Ni Luh Widya, Ariel Jason, Nadhira Shabila, and Novey Riyanti for their assistance in data collection.

References

1. Dworkin SF, Huggins KH, LeResche L, et al. Epidemiology of signs and symptoms in temporomandibular disorders: clinical signs in cases and controls. J Am Dent Assoc. 1990;120(3):273-281.
2. de Leeuw R, Klasser GD. Diagnosis and management of TMDs. In: de Leeuw R, ed. Orofacial pain: guidelines for assessment, diagnosis, and management. Batavia (IL): Quintessence Publishing Co.; 2013:127-186.
3. Kalaykova S, Lobbezoo F, Naeije M. Effect of chewing upon disc reduction in the temporomandibular joint. J Orofac Pain. 2011;25(1):49-55.
4. Yap AU, Natu VP. Inter-relationships between pain-related temporomandibular disorders, somatic and psychological symptoms in Asian youths. J Oral Rehabil. 2020;47(9):1077-1083.
5. Marpaung C, van Selms MKA, Lobbezoo F. Prevalence and risk indicators of pain-related temporomandibular disorders among Indonesian children and adolescents. Community Dent Oral Epidemiol. 2018;46(4):400-406.
6. Schiffman E, Ohrbach R, Truelove E, et al. Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for Clinical and Research

Applications: recommendations of the International RDC/TMD Consortium Network and Orofacial Pain Special Interest Group. J Oral Facial Pain Headache. 2014;28(1):6-27.

7. Ryff CD. Psychological well-being revisited: advances in the science and practice of eudaimonia. Psychother Psychosom. 2014;83(1):10-28.
8. Seligman ME, Csikszentmihalyi M. Positive psychology. An introduction. Am Psychol. 2000;55(1):5-14.
9. Friedli L, World Health Organization. Regional Office for E. Mental health, resilience and inequalities / by Lynne Friedli. Copenhagen : WHO Regional Office for Europe: 2009. Available from: https://apps.who.int/iris/handle/10665/107925
10. Henry JD, Crawford JR. The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a large non-clinical sample. Br J Clin Psychol. 2005;44(2):227-239.
11. Ryff CD, Keyes CL. The structure of psychological well-being revisited. J Pers Soc Psychol. 1995;69(4):719-727.
12. Oei TPS, Sawang S, Goh YW, et al. Using the Depression Anxiety Stress Scale 21 (DASS-21) across cultures. Int J Psychol. 2013;48(6):1018-1029.
13. Lovibond SH, Lovibond PF. A manual for the Depression Anxiety Stress Scales: Psychology Foundation of Australia; 1996.
14. Schiffman E, Ohrbach R. Executive summary of the Diagnostic Criteria for Temporomandibular Disorders for clinical and research applications. J Am Dent Assoc. 2016;147(6):438-445.
15. Manfredini D, Guarda-Nardini L, Winocur E, et al. Research Diagnostic Criteria for Temporomandibular Disorders: a systematic review of axis I epidemiologic

findings. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2011;112(4):453-462.

16. Liu Q, Shono M, Kitamura T. Psychological well-being, depression, and anxiety in Japanese university students. Depress Anxiety. 2009;26(8):E99-105.
17. Lei J, Fu J, Yap AU, et al. Temporomandibular disorders symptoms in Asian adolescents and their association with sleep quality and psychological distress. CRANIO®. 2016;34(4):242-249.
18. Fillingim RB, Ohrbach R, Greenspan JD, et al. Potential psychosocial risk factors for chronic TMD: descriptive data and empirically identified domains from the OPPERA case-control study. J Pain. 2011;12(11 Suppl):T46-60.
19. Monteiro DR, Zuim PR, Pesqueira AA, et al. Relationship between anxiety and chronic orofacial pain of temporomandibular disorder in a group of university students. J Prosthodont Res. 2011;55(3):154-158.
20. Choi E, Chentsova-Dutton Y, Parrott WG. The Effectiveness of somatization in communicating distress in Korean and American cultural contexts. Front Psychol. 2016;7:383.
21. Polmann H, Domingos FL, Melo G, et al. Association between sleep bruxism and anxiety symptoms in adults: A systematic review. J Oral Rehabil. 2019;46(5):482-491.
22. Su N, Lobbezoo F, van Wijk A, et al. Associations of pain intensity and pain-related disability with psychological and socio-demographic factors in patients with temporomandibular disorders: a cross-sectional study at a specialised dental clinic. J Oral Rehabil. 2017;44(3):187-196.
23. Gui MS, Rizzatti-Barbosa CM. Chronicity factors of temporomandibular disorders: a critical review of the literature. Braz Oral Res. 2015;29:1-6

24. McCreary CP, Clark GT, Merril RL, et al. Psychological distress and diagnostic subgroups of temporomandibular disorder patients. Pain. 1991;44(1):29-34.
25. Huber A, Suman AL, Biasi G, et al. Predictors of psychological distress and well-being in women with chronic musculoskeletal pain: two sides of the same coin? J Psychosom Res. 2008;64(2):169-175.
26. Simoneau H, Bergeron J. Factors affecting motivation during the first six weeks of treatment. Addict Behav. 2003;28(7):1219-1241.
27. Steinberg L, Morris AS. Adolescent development. Annu Rev Psychol. 2001;52(1):83-110.
28. Gao J, McLellan R. Using Ryff's scales of psychological well-being in adolescents in mainland China. BMC Psychol. 2018;6(1):17.
29. Hilton L, Hempel S, Ewing BA, et al. Mindfulness meditation for chronic pain: Systematic review and meta-analysis. Ann Behav Med. 2017;51(2):199-213.
30. Oghli I, List T, Su N, et al. The impact of oro-facial pain conditions on oral health-related quality of life: A systematic review. J Oral Rehabil. 2020;47(8):1052-1064.
31. Bergstrand S, Ingstad HK, Møystad A, et al. Long-term effectiveness of arthrocentesis with and without hyaluronic acid injection for treatment of temporomandibular joint osteoarthritis. J Oral Sci. 2019;61(1):82-88.
32. Prinz JF. Physical mechanisms involved in the genesis of temporomandibular joint sounds. J Oral Rehabil. 1998;25(9):706-714.

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
		Mean ± SD	Median (IQR)	Mean ± SD	Median (IQR)	Mean ± SD	Median (IQR)	Mean ± SD	Median (IQR)		(1-2)
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.

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).

TMD PAIN						
	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						
	Single regression model			Multiple regression model (n=261)		
Variable	OR	95% CI	*p* value	OR	95% CI	*p* value
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						
	Single regression model			Multiple regression model (n=252)		
Variable	OR	95% CI	*p* value	OR	95% CI	*p* value
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			
Total SPWB score	0.97	0.94-0.99	0.017*			

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

02. Bukti konfirmasi review

24 Mei 2021

Carolina Marpaung <carolina@trisakti.ac.id>

(CRANIO: The Journal of Craniomandibular & Sleep Practice) A revise decision has been made on your submission

Editorial Office, CRANIO: The Journal of Craniomandibular & Sleep Practice <em@editorialmanager.com> Mon, May 24, 2021 at 8:32 PM
Reply-To: "Editorial Office, CRANIO: The Journal of Craniomandibular & Sleep Practice" <contact@cranio.com>
To: Carolina Marpaung <carolina@trisakti.ac.id>

Ref.: CRN1407
Psychological distress and well-being: Their association with Temporomandibular disorder symptoms and inter-relationships
CRANIO: The Journal of Craniomandibular & Sleep Practice

Dear Dr Marpaung

We have now received reviewers' comments on the above submission. I am pleased to tell you that the reviews were positive and I would hope to be able to accept it for publication in CRANIO: The Journal of Craniomandibular & Sleep Practice, once you have dealt with the points raised by the referee(s). These points are detailed in the comments below.

We look forward to receiving a revised version of your paper, prepared in the light of these comments, by 23 Jun 2021.

To submit a revision, go to https://www.editorialmanager.com/crn/ and log in as an Author:
Your username is: c.marpaung
https://www.editorialmanager.com/crn/l.asp?i=117727&l=L5TKSBP8

You will see a menu item entitled 'Submission Needing Revision'. Your submission record may be viewed there.

When resubmitting, please indicate clearly your response to the reviewers' comments. These should appear in a document uploaded separately with the revised manuscript. Ideally, your revised manuscript should include the changes you have made shown in red type. Do not use "Track Changes" on your revised manuscript. Do not include authors' names on your Comments to Reviewers.

Please ensure that you supply a final text file of your revised manuscript, prepared according to the specification in the instructions for authors at http://tandfonline.com/action/authorSubmission?journalCode=ycra20&page=instructions#.Vxoi2XErJhF and a high resolution image file of each figure. Failure to do this may result in a delay in the typesetting of your paper. Please note that it is not permitted to submit a PDF file of the revised manuscript at this stage.

Please also note that incomplete and duplicate references must be corrected in the final text before it will be considered for publication.

Language and language-editing
Submissions are vetted for quality of English and may be rejected on these grounds. Authors may wish to use a language-editing service to refine the use of English in their manuscript before submission. For information about Taylor & Francis' language-editing services please visit http://www.tandfeditingservices.com/en/.

Use of an editing service does not guarantee that your paper will be accepted for publication. A decision will be made following the usual peer review process.

Thank you once again for kindly submitting your work to our Journal.

With best wishes,

Riley H. Lunn, D.D.S.
Editor-in-Chief
CRANIO: The Journal of Craniomandibular & Sleep Practice

Comments from the Editors and Reviewers:

Reviewer #1: 1.Title:
This needs to be changed to eliminate "and Inter-relationships" This is not covered specifically in the paper or conclusions.
2. Crepitus has a totally different significance than popping and therefore should have been evaluated separately. Use of the DC/TMD SQ did not allow for separation of these into separate categories and therefore may have skewed the results. This should be noted in the paper, especially since joint noises showed some increase in anxiety and less autonomy than pain patients.
3. Table 1 is confusing, as the left column is not labeled as to what is normal, Mild, Moderate, severe or extremely severe. Th Depression, Anxiety, Stress or the TMD. Either way, I cannot make sense of the table.
If TMD is severe, how does this relate to the no TMD symptoms? If the table related to severity of depression, how can there be a normal category? Please make this table more clear.
4. Table 3. I do not understand combining the different groups. Pain always makes the group more significant, as expected. There is already an appropriate combined group, why add more?

Reviewer #2: The only novel part of this manuscript is psychological well-being; that is not a negative comment: the positive aspects of psychology are too often neglected. The authors do an acceptable job with the DASS-based measures and the well-being measures. However, the correlational approach is fairly minimal and not terribly informative. The construction of 4 groups, however, represents a good target by which more sophisticated multivariable model could be pursued.

The use of abbreviations such as TP for designating groups represent a huge burden for the reader in trying to keep track of which abbreviation represents which concept regarding symptomatology. Far better are names such as control, pain only, sounds only, and mixed. These are just examples.

The authors use two instruments for psychological constructs, and the DC/TMD symptom questionnaire. Nowhere do they state what language version is used, and if a translation whether the translation is a valid one.

At present, the methods and results inadequately describe how the statistical analyses were done. For example, the authors have 4 groups; what role does logistic regression have in this design? This is not at all clear.

Why scores, typically considered to be of at least integer quality, are compared with the K-W or Mann-Whitney tests is not explained; absence of normal distribution for the observed values is not the justification to use nonparametric statistics. For a group comparison design, either ANOVA or linear regression (depending on how authors want to interpret the obtained statistics) is the appropriate method, and normal distribution of the errors is the necessary assumption. ANOVA is robust to those violoations up to a point, and robust statistics can be employed. The authors need to therefore decide: present means or medians? To that end, the severity categories in Table 1 are disjunctive with the mean and median scores in Table 2. In short, the authors need to decide on what is the form of the measurement, and choose one way to present descriptive statistics and compare groups. Table 2 is currently too complex, for little to no gain in information useful to the aim of the study.

Results presented in the tables should not be repeated in the text.

Table 3, as a table of p-values, needs to be replaced by a table with informative data.

Table 4: correlations should be sufficiently precise at hundredths precision, not the present thousandths. There is no gain in this false precision. the asterisks can be dropped, and use the legend to simply state that all correlations were significant. Significance of correlations, however, is another distracting path, in that significance is driven by sample size very acutely when correlations are concerned. Of greater importance is whether the observed correlations accord with hypothesis, and what the pattern might represent. Finallyk it is not at all obvious how a correlation was computed for each of the groups. Far more informative would be odds ratios, using "no TMD" as the reference group, for each of the measures. Scores should be standardized in order for them to have same measurement scale. Note that in this table, the group names are spelled out. The same labels should be used in all tables and throughout the manuscript. In one sense, the authors pursue exactly this path in Table 5. However, the methods do not explain the approach or rationale for Table 5, nor is the multiple regression model explained (or its absence). Finally, OR should be no more than hundredths in precision. The comparison to the no TMD group needs to be made explicit as the reference group. Overall, the table would benefit from some revision in format; please consult good epidemiological journals for best practice.

In summary, the data analysis plan will benefit from careful evaluation and revision as needed to create a more streamlined approach.

Finally, some of these comments will apply to improving the abstract: it explains too little.

Reviewer #3: The article was well structured and information was clearly presented. The authors appropriately selected and applied several statistical methods including those for supporting the sample selection, normality testing, correlation analysis, logistic regression both univariate and multivariate models. The author also recognized the limitations of the study.

Managing Editor (1) Remove the numbers from in front of headings and subheadings (not the line numbers).
(2) Is Reference #13 a book? If so, please provide the city of the publisher.
(3) Use red type for all changes (NOT red highlighting). Do not use track changes. Do not include any author names or identifying information in your Response to Reviewers Comments document, in order to maintain our double-blind reviewer process.
Thank you.

03. Bukti respon ke reviewer

6 Juli 2021

Author's Response To Reviewer Comments

Close

6 July 2021

Dr. Riley H Lunn
Editor-in-chief
The Journal of Craniomandibular & Sleep Practice (CRANIO)

Dear Dr. Lunn,

Thank you for considering our manuscript entitled "Psychological distress and well-being: Their association with Temporomandibular disorder symptoms" for possible publication in the Journal of Craniomandibular & Sleep Practice (CRANIO).

We are grateful for the reviewers' support and constructive feedback that has helped improve our manuscript.

All issues were addressed, and the recommended changes made are highlighted in RED in the revised manuscript.

The aforementioned are detailed below together with responses to their concerns.

Reviewer #2

1.Prior comment 4: "correlate" is not the correct term for the updated text. "Association" links nicely to odds ratios as the statistic of interest.

Our response: Thank you for noting the detail. We have revised the text as suggested.

Revised text: 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 group.

2. Prior comment 5: authors state that they used medians as descriptive statistics because the DASS and SPWB were not normally distributed. Fair enough. But they further state that they used medians because "the outcomes were not independent"; this, however, is not a reason to choose medians vs means for descriptive statistics. Rather, presence or absence of independence of outcomes points to the selection of a model for testing associations. Please revise the rationale for selection of statistical form for descriptive statistics. Moreover, medians are typically less informative than using, say, tertiles or quartiles, and then reporting frequencies as the descriptive statistic and using the formed groups for further associations. Far more information is gained in this way than simply comparing a non-parametric distribution with an outcome. Finally, if the outcomes were not independent, then this needs to be better explained, perhaps as a separate paragraph: why not independent, and rationale for selected statistical model that can address non-independent outcomes.

Our response: We apologize for the previous response. We agree with you and the consideration of presenting the data as medians and continue with non-parametric analysis is because DASS-21 and SPWB-18 were not normally distributed.

3. Prior comment 6: This text "anxiety - TMJ pain, TMJ sounds, combined TMD > No TMD; stress - TMD pain, Combined TMD > No TMD; and autonomy - No TMD > TMJ pain, TMJ sounds, combined TMD." is impenetrable as English. This must be rewritten as a statement (or series of statements) that will convey the complexity implied by the grouped arguments.

Our response: As suggested, we have clarified this part of the article

Revised text: 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 no TMD group; stress – TMD pain and combined TMD are higher than no TMD group; and autonomy – No TMD is higher than TMJ pain, TMJ sounds, and combined TMD group.

4. Prior comment 7: This pertains to new Table 2 content, which displays a correlation matrix of psychological well-being, stratified by TMD group, with depression, anxiety, and stress. The statistics range from -0.30 to -0.74. Is there a meaningful pattern or is this just a random set of correlations that explain from 10-50% of the variance from one variable to the other? The authors conclude, in the Discussion, that depression had the strongest correlations with psychological well-being (range -0.59 - -0.74), and certainly that variable has correlations with the a certain range interpretable as the authors note. However, anxiety ranges -0.30 to -0.71, overlapping a notable bit with the range for depression. Does this mean that depression is truly higher? The authors need to consider the confidence limits around the correlation point estimates before concluding that depression actually has a stronger relationship with well-being. Similarly, the correlations of stress with well-being are situated within the range of those for anxiety with well-being. If the rows are considered, a perhaps more informative pattern emerges -- but again, confidence limits might challenge any interpretation. In summary, the authors are regarding depression, anxiety, and stress as separable measures; however, all 3 are connected via the DASS, and high correlations between depression, anxiety, and stress are suspected, for two reasons: the constructs are not always so readily distinguished, and in this instance, they will have shared methods variance due to the DASS instrument. An alternative approach is to either consider a DASS total score rather than, or in addition to, individual measures (if the DASS produces a total score) or to consider a principle component model for reducing the three scores to one. This might yield more informative information for Table 2 -- pitting well-being (statified by diagnostic group) against distress. Collapsing the individual measures of the DASS will also improve, most likely, measurement precision for the distress measure; currently the associations in the distress sections of Table 3 for TMD pain are weak. These comments are provided only as suggestions, in that how to model this type of data has no right approach; strong conceptual considerations regarding intent behind the aims vs the nature of the measures for the intended constructs can lead to stronger modeling.

Our response: We thank you for your thorough review and inputs. Indeed, there is an overlap between anxiety and depression correlation range. When we look at their correlations on each TMD group, depression tends to have a higher correlation score (-0.63, -0.74, -0.59, and -0.71) than anxiety and stress. For DASS-21, we understand that there are ongoing discussions and publications about the dimensions of DASS-21 and the possibility of analyzing it as a total number. However, our goal for this article was to observe the relation of each distress component to specific psychological well-being. Having read your review, we see it as an opportunity for further research on DASS-21.

5. Prior comment 8. The authors improved presentation of point estimates, but they continue to utilize old-school statistical approaches: use of univariate models for selecting which variables will be entered into a multivariable model is in violation of variable selection concerns and can lead to biased outcomes. Please refer to the abundant material available via the internet regarding why stepwise regression is not a good approach. Here are several of my favorites: http://www.philender.com/courses/linearmodels/notes4/swprobs.html
and https://towardsdatascience.com/stopping-stepwise-why-stepwise-selection-is-bad-and-what-you-should-use-instead-90818b3f52df

Our response: Thank you for raising your concern about the downside of a stepwise regression method. Despite the possible bias and inability to build a predictive model, this method is still appropriate for variable evaluation. In this study, model reduction provided by the stepwise method showed anxiety's association to TMD and lower autonomy well-being to TMJ sounds. This finding gave the foundation to do further studies on TMD patients with more detailed tools on anxiety and autonomy.

We look forward to hearing from you on the status of our revised manuscript.

Close

04. Bukti konfirmasi artikel diterima

18 Agustus 2021

Date: 18 Aug 2021
To: "Carolina Marpaung" carolina@trisakti.ac.id
cc: "Adrian Ujin Yap" aujyaprd@gmail.com, "Isya Hanin" isya.hanin@gmail.com, "Astrya Fitryanur" astryafn@gmail.com
From: "Riley H. Lunn" contact@cranio.com
Subject: %DOI% (CRANIO: The Journal of Craniomandibular & Sleep Practice) Your submission has been accepted

Ref.: CRN1407R2
Psychological distress and well-being: Their association with Temporomandibular disorder symptoms.
CRANIO: The Journal of Craniomandibular & Sleep Practice

Dear Dr Marpaung
Thank you for submitting a revised version of the above submission and your response to the comments made by the reviewers. I am pleased to confirm that the paper is accepted for publication in CRANIO: The Journal of Craniomandibular & Sleep Practice. It was accepted on 18 Aug 2021.

Thank you for submitting your work to CRANIO: The Journal of Craniomandibular & Sleep Practice.

With kind regards

Riley H. Lunn, D.D.S.
Editor-in-Chief
CRANIO: The Journal of Craniomandibular & Sleep Practice

Comments from the Editors and Reviewers:

Reviewer #2: None

CRANIO®: THE JOURNAL OF CRANIOMANDIBULAR & SLEEP PRACTICE
2024, VOL. 42, NO. 3, 285–291
https://doi.org/10.1080/08869634.2021.1971449

Taylor & Francis
Taylor & Francis Group

TMJ

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

Carolina Marpaung BDS, MDS, PhD[a], Adrian Ujin Yap BDS, MSc, PhD, Grad Dip Psychotherapy[a,b,c], Isya Hanin BDS, MDS[a] and Astrya Fitryanur BDS[a]

[a]Department of Prosthodontics, Faculty of Dentistry, Trisakti University, Jakarta, Indonesia; [b]Department of Dentistry, Ng Teng Fong General Hospital and Faculty of Dentistry, National University Health System, Singapore, Singapore; [c]National Dental Research Institute Singapore, National Dental Centre Singapore and Duke-NUS Medical School, SingHealth, Singapore, Singapore

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

CONTACT Carolina Marpaung carolina@trisakti.ac.id Department of Prosthodontics, Faculty of Dentistry, Trisakti University, Jl Kyai Tapa No 260, Jakarta 1140, Indonesia

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 derive 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.

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.

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 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.

Acknowledgments

The authors would like to thank the Faculty of Dentistry, Trisakti University for supporting and Ni Luh Widya, Ariel Jason, Nadhira Shabila, and Novey Riyanti for their assistance in data collection.

Disclosure statement

The authors have no financial or personal conflict of interest to report relating to this article.

Funding

No funding was received for this study.

ORCID

Carolina Marpaung BDS, MDS, PhD http://orcid.org/0000-0002-9621-6257

References

[1] Dworkin SF, Huggins KH, LeResche L, et al. Epidemiology of signs and symptoms in temporomandibular disorders: clinical signs in cases and controls. J Am Dent Assoc. 1990;120(3):273–281. DOI:10.14219/jada.archive.1990.0043.

[2] de Leeuw R, Klasser GD. Diagnosis and management of TMDs. In: de Leeuw R, editor. Orofacial pain: guidelines for assessment, diagnosis, and management. Batavia (IL): Quintessence Publishing Co.; 2013. p. 127–186.

[3] Kalaykova S, Lobbezoo F, Naeije M. Effect of chewing upon disc reduction in the temporomandibular joint. J Orofac Pain. 2011;25(1):49–55.

[4] Yap AU, Natu VP. Inter-relationships between pain-related temporomandibular disorders, somatic and psychological symptoms in Asian youths. J Oral Rehabil. 2020;47(9):1077–1083.

[5] Marpaung C, van Selms MKA, Lobbezoo F. Prevalence and risk indicators of pain-related temporomandibular

disorders among Indonesian children and adolescents. Community Dent Oral Epidemiol. 2018;46(4):400–406.
[6] Schiffman E, Ohrbach R, Truelove E, et al. Diagnostic Criteria for Femporomandibular Disorders (DC/TMD) for Clinical and Research Applications: recommendations of the International RDC/TMD Consortium Network and Orofacial Pain Special interest Group. J Oral Facial Pain Headache. 2014;28(1):6–27. DOI:10.11607/jop.1151.
[7] Ryff CD. Psychological well-being revisited: advances in the science and practice of eudaimonia. Psychother Psychosom. 2014;83(1):10–28.
[8] Seligman ME, Csikszentmihalyi M. Positive psychology. An introduction. Am Psychol. 2000;55(1):5–14.
[9] Friedli L. World Health Organization. Regional Office for E. Mental health, resilience and inequalities/by Lynne Friedli. Denmark: Copenhagen: WHO Regional Office for Europe; 2009. Available from: https://apps.who.int/iris/handle/10665/107925 Access Date 13 January 2020.
[10] Henry JD, Crawford JR. The short-form version of the depression anxiety stress scales (DASS-21): construct validity and normative data in a large non-clinical sample. Br J Clin Psychol. 2005;44(2):227–239.
[11] Ryff CD, Keyes CL. The structure of psychological well-being revisited. J Pers Soc Psychol. 1995;69 (4):719–727.
[12] Oei TPS, Sawang S, Goh YW, et al. Using the Depression Anxiety Stress Scale 21 (DASS-21) across cultures. Int J Psychol. 2013;48(6):1018–1029. DOI:10.1080/00207594.2012.755535.
[13] Lovibond SH, Lovibond PF. A manual for the Depression Anxiety Stress Scales: Psychology Foundation of Australia; 1996.
[14] Schiffman E, Ohrbach R. Executive summary of the Diagnostic Criteria for Temporomandibular Disorders for Clinical and Research Applications. J Am Dent Assoc. 2016;147(6):438–445.
[15] Manfredini D, Guarda-Nardini L, Winocur E, et al. Research Diagnostic Criteria for Temporomandibular Disorders: a systematic review of axis I epidemiologic findings. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2011;112(4):453–462. DOI:10.1016/j.tripleo.2011.04.021.
[16] Liu Q, Shono M, Kitamura T. Psychological well-being, depression, and anxiety in Japanese university students. Depress Anxiety. 2009;26(8):E99–105.
[17] Lei J, Fu J, Yap AU, et al. Temporomandibular disorders symptoms in Asian adolescents and their association with sleep quality and psychological distress. CRANIO®. 2016;34(4):242–249. DOI:10.1179/2151090315Y.0000000021.
[18] Fillingim RB, Ohrbach R, Greenspan JD, et al. Potential psychosocial risk factors for chronic TMD: descriptive data and empirically identified domains from the OPPERA case-control study. J Pain. 2011;12(11 Suppl):T46–60. DOI:10.1016/j.jpain.2011.08.007.
[19] Monteiro DR, Zuim PR, Pesqueira AA, et al. Relationship between anxiety and chronic orofacial pain of temporomandibular disorder in a group of university students. J Prosthodont Res. 2011;55 (3):154–158. DOI:10.1016/j.jpor.2010.11.001.
[20] Choi E, Chentsova-Dutton Y, Parrott WG. The Effectiveness of somatization in communicating distress in Korean and American cultural contexts. Front Psychol. 2016;7:383.
[21] Polmann H, Domingos FL, Melo G, et al. Association between sleep bruxism and anxiety symptoms in adults: a systematic review. J Oral Rehabil. 2019;46(5):482–491. DOI:10.1111/joor.12785.
[22] Su N, Lobbezoo F, van Wijk A, et al. Associations of pain intensity and pain-related disability with psychological and socio-demographic factors in patients with temporomandibular disorders: a cross-sectional study at a specialised dental clinic. J Oral Rehabil. 2017;44 (3):187–196. DOI:10.1111/joor.12479.
[23] Gui MS,Rizzatti-Barbosa CM.Chronicity factors of temporomandibular disorders: a critical review of the literature. Braz Oral Res. 2015;29:1–6.
[24] McCreary CP, Clark GT, Merril RL, et al. Psychological distress and diagnostic subgroups of temporomandibular disorder patients. Pain. 1991;44(1):29–34. DOI:10.1016/0304-3959(91)90143-L.
[25] Huber A, Suman AL, Biasi G, et al. Predictors of psychological distress and well-being in women with chronic musculoskeletal pain: two sides of the same coin? J Psychosom Res. 2008;64(2):169–175. DOI:10.1016/j.jpsychores.2007.09.005.
[26] Simoneau H, Bergeron J. Factors affecting motivation during the first six weeks of treatment. Addict Behav. 2003;28(7):1219–1241.
[27] Steinberg L, Morris AS. Adolescent development. Annu Rev Psychol. 2001;52(1):83–110.
[28] Gao J,McLellan R. Using Ryff's scales of psychological well-being in adolescents in mainland China. BMC Psychol. 2018;6(1):17.
[29] Hilton L, Hempel S, Ewing BA, et al. Mindfulness meditation for chronic pain: systematic review and meta-analysis. Ann Behav Med. 2017;51(2):199–213. DOI:10.1007/s12160-016-9844-2.
[30] Oghli I, List T, Su N, et al. The impact of oro-facial pain conditions on oral health-related quality of life: a systematic review. J Oral Rehabil. 2020;47 (8):1052–1064. DOI:10.1111/joor.12994.
[31] Bergstrand S, Ingstad HK, Møystad A, et al. Long-term effectiveness of arthrocentesis with and without hyaluronic acid injection for treatment of temporomandibular joint osteoarthritis. J Oral Sci. 2019;61(1):82–88. DOI:10.2334/josnusd.17-0423.
[32] Prinz JF. Physical mechanisms involved in the genesis of temporomandibular joint sounds. J Oral Rehabil. 1998;25(9):706–714.