

Role of mental state in temporomandibular disorders: A review of the literature

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Abstract

Temporomandibular disorders (TMD) constitute a heterogeneous group of disorders concerning temporomandibular joints (TMJ) and the surrounding structures. The etiology is multifactorial, and comprises biological factors (e.g., internal derangements in TMJ), psychological factors (e.g., depression, anxiety and stress) and social factors (e.g., a learned response to pain). In accordance with the biopsychosocial model of health and illness, psychological factors are recognized as highly significant in the development of TMD.

The aim of this review was to present the role of chosen mental disorders (depression, anxiety) in TMD and their significance for dental practitioners in the light of current knowledge. The PubMed, Scopus and Web of Science databases were searched for relevant studies. Finally, 22 studies were included in this review. The gathered literature shows convincing evidence that mental derangements play a significant role in TMD by influencing the onset of the disorder, the course of the condition and the patient's response to treatment. However, the precise role of each mental disorder still requires further clarification.

Key words: depression, anxiety, temporomandibular disorders, mental disorders

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Introduction

'Temporomandibular disorders' (TMD) is an umbrella term for a heterogeneous group of disorders concerning temporomandibular joints (TMJ) and the surrounding structures. Temporomandibular disorders are the second most common cause of pain in the orofacial region after toothache.¹ The prevalence of TMD in the general population is estimated at around 40%.² In young adults, the prevalence of TMD symptoms varies from 42.9% up to 60%.³⁻⁷ The most common symptoms are: pain of the masticatory muscle or in the joint area; headache; reduced mobility of the mandible, and joint sounds.⁸ The etiology of TMD is multifactorial,⁹⁻¹¹ and comprises biological factors (e.g., internal derangements in TMJ), psychological factors (e.g., depression, anxiety and stress) and social factors (e.g., a learned response to pain).¹² The Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) introduced by Dworkin and LeResche in 1992,¹³ later updated to Diagnostic Criteria for Temporomandibular Disorders (DC/TMD), is an internationally accepted tool for diagnosing TMD based on the biopsychosocial model of health and illness. The RDC/TMD and the latest DC/TMD function as a two-axis system. Axis I focuses on diagnosing biological factors based on physical examination, and Axis II refers to psychosocial factors, studied by means of a series of questionnaires.¹³ The two-axis structure proposed in this diagnostic tool brings out the importance of psychosocial factors in TMD, which are still often underestimated or unknown by various clinicians working in the field of dentistry.

The aim of this review was to present the role of chosen mental disorders (depression, anxiety) in TMD and their significance for dental practitioners in the light of current knowledge.

Material and methods

The authors searched 3 electronic databases – PubMed, Scopus and Web of Science – for articles describing the relationship between anxiety or depression and TMD. Only original, English-language articles were included. Also the bibliography of the obtained studies was searched for relevant articles. Then, the retrieved papers underwent a qualitative analysis. Finally, 22 articles were included in this review.

Results and discussion

Mental disorders, such as depression or anxiety, are considered by some authors as the potential causes of TMD symptoms.^{14,15} They play an important role in the onset

of TMD and its perpetuation.¹⁶⁻¹⁸ Some authors consider psychosocial comorbid conditions as predictors of a less favorable response to classical therapy.¹⁹

The precise mechanisms linking psyche and TMD are unknown. Potentially, stress may alter the threshold of pain perception in the central nervous system, increase the intensity of parafunctional habits as well as masticatory muscle fatigue and tightness, and initiate the disorder.^{14,15} Or the other way round – pain (especially chronic), through the constant input of painful stimuli, induces central sensitization and causes permanent changes in the central nervous system.²⁰ Pain and psychological distress seem to create a dynamic vicious circle, in which mental disorders intensify the perceived pain and the perceived pain worsens the course of mental disorders. In many cases, it is hard to distinguish the cause from the effect.²¹ The mechanism may also be associated with the dysregulation of the hypothalamic–pituitary–adrenal axis, leading to the production of excessive amounts of stress hormones, such as cortisol and catecholamines. The axis hormones are associated with mental disorders, such as depression, and other somatic illnesses, such as diabetes, hypertension or facial pain.²²⁻²⁴ Other studies confirmed that patients diagnosed with TMD presented with statistically significantly higher levels of stress hormones in comparison with healthy controls.^{25,26}

Depression

A depressive episode is characterized by subsequent symptoms: low mood; loss of interest or no sense of pleasure; psychomotor agitation or retardation; fatigue or loss of energy; significant changes in weight; strong belief in own worthlessness or a sense of guilt; impaired concentration; and hypersomnia or insomnia.²⁷⁻²⁹ Patients suffering from depression are at higher risk of committing suicide.³⁰

In the last 20 years, the prevalence of depression has increased by 49.86% and it is estimated that during lifetime, 20% of the society will develop this illness.³¹⁻³³

The most commonly used questionnaires diagnosing depression are: the Hospital Anxiety and Depression Scale (HADS)¹; the Patient Health Questionnaire-9 (PHQ-9)³⁴; the Symptom Checklist-90-Revised (SCL-90R)^{35,36}; and the Beck Depression Inventory (BDI).³⁷ The usage of those questionnaires as diagnostic tools is very convenient and time-saving from the point of view of the doctor. Still, it has to be marked that questionnaires can only serve as screening tools for certain psychological disorders, and indicate patients that need a definitive diagnosis and treatment provided by the psychiatrist.^{1,38}

Patients with TMD present with higher levels of depression as compared to healthy controls.^{29,39,40} Some studies divided TMD patients based on pain, reporting significantly higher levels of depression in patients

with painful TMD than in the case of non-painful TMD.^{36,41,42} What is worth noticing in those studies is the fact that the precise localization of pain (diagnosis from Axis I) was not significant.^{36,41,42} Others divided patients based on the duration of the symptoms, reporting significantly higher levels of depression in patients with chronic TMD than those with acute TMD.^{20,38} In the above-mentioned studies, chronic TMD was defined as lasting at least 3 months. One of the studies focused on changes in the perceived symptoms of TMD at the time of higher and lower levels of depression and anxiety.⁴³ A significant difference was found only in the maximum mouth opening without pain and the level of self-estimated mandibular impairment. The maximum mouth opening without pain was decreased and the level of self-estimated mandibular impairment was increased at the time of a high level of depression. On the other hand, non-significant differences were found in the number of tender points or the electromyographic activity of the masticatory muscle, which seemed not to depend on the level of anxiety and depression.⁴³

Korszun et al. conducted an interesting study, in which patients with chronic facial pain underwent full medical and psychiatric assessment according to the Diagnostic and Statistical Manual of Mental Disorders IV (DSM-IV) criteria.²⁶ The percentage of patients diagnosed with depression or symptoms characteristic of depression was statistically significantly higher among patients with chronic facial pain than in healthy controls. Interestingly, fatigue and insomnia were the most common symptoms, reported by 92% of patients with a diagnosis of depression and 50% of patients presenting with only some depressive symptoms. By comparison, 38% of controls reported those symptoms. An important issue is that 50% of patients fulfilling the DSM-IV criteria for depression received this diagnosis for the first time, despite various previous consultations. This fact might indicate that the number of patients with TMD requiring a specialist psychiatric consultation is underestimated by various practitioners. No statistically significant differences in the occurrence of depression between TMD patients and chronic facial pain patients of different origin was found, either. Thus, the significant variable correlated with depression could be pain, not TMD.^{26,44} Several studies suggest that depression and chronic pain syndromes share the same neurological pathways and neurotransmitters (such as norepinephrine, glutamate and serotonin), and involve the same brain structures (such as the anterior cingulate cortex, the prefrontal cortex, the amygdala, and the hippocampus).^{45–47} Furthermore, both chronic pain and depression aggravate each other, and cause maladaptive changes in the brain function and structure.^{46,47} Chronic pain intensifies depressive symptoms by causing distress.⁴⁶ Depression

on the other hand may be a result of monoamine neurotransmitter deficiency, which leads to increased sensitivity to painful stimuli.⁴⁵ It is also suggested that depression may be considered as an inflammatory process in the brain due to increased levels of pro-inflammatory cytokines, which results in higher pain sensitivity.⁴⁶ Therefore, early diagnosis and proper treatment are crucial.

Another interesting finding is that young children who had contact with adults with depression are at increased risk of the development of painful TMD in their early adulthood.⁴⁸

Table 1 presents a summary of data regarding depression from the most important studies included in the review.

Anxiety

Anxiety is characterized by a sense of worry, difficult to control and causing a feeling of restlessness, fatigue, a sense of tension, nervousness, and sleep disturbance.^{27,49} In some studies, in which the Spielberger State-Trait Anxiety Inventory (STAI) was used, 2 types of anxiety were distinguished: state-anxiety, which is associated with the current level of anxiety and is transitory; and trait-anxiety, which expresses one's personality and is more stable during lifetime.⁵⁰ Anxiety is recognized as the most common mental disorder in the European Union and it is 3 times more frequently diagnosed in women than men.⁵¹

Studies employ various questionnaires to diagnose anxiety. These are: HADS^{1,37}; STAI^{15,37,52,53}; the Beck Anxiety Inventory (BAI)^{37,52}; the Generalized Anxiety Disorder-7 (GAD-7)³⁴; and SCL-90R.^{35,36}

The role of anxiety in TMD is still rather controversial. Many studies suggest the existence of a correlation between TMD and anxiety,^{3,37,54–56} but other researchers present contradictory results,^{1,20,57–59} seeing anxiety as a less important factor in the case of TMD patients than depression.^{1,20} The different results of the presented studies may be explained by differences in many important variables, such as the population under study, the study design and the questionnaire used.

Those authors who managed to find a correlation between TMD and anxiety reported significantly higher levels of anxiety in patients with TMD as compared to healthy controls. The individuals affected by anxiety were up to 5 times more prone to develop TMD than non-TMD patients.⁴⁸ A correlation was found in both acute⁶⁰ and chronic TMD.⁶¹ Severe anxiety levels increased by twice the probability of chronic pain, disability and depression,⁵³ and the level of anxiety correlated with the duration of the disorder.²⁰

Regarding one of the subtypes of anxiety, the analyzed articles were consistent. Trait-anxiety occurred more often in patients with TMD than healthy controls.^{15,53}

Table 1. Summary of data regarding depression from the most important studies included in the review

Study	Population	Study group	Control group	TMD diagnosing tool	Psychiatric diagnosing tool	Correlation	Conclusion
Giannakopoulos et al. (2010) ¹	N = 222 61 men 161 women	chronic, painful TMD	non-painful TMD, patients without chronic facial pain	RDC/TMD	HADS	+	significantly higher levels of depression in the study group
Cao et al. (2020) ²⁰	N = 830	TMD subgroups	TMD subgroups	RDC/TMD	DASS-21	+/-	significantly higher levels of depression only in the chronic, painful TMD subgroup
Korszun et al. (1996) ²⁶	N = 72	TMD	chronic facial pain	University of Washington criteria	psychiatric examination	-	no significant correlation found
Simoen et al. (2020) ³⁴	N = 243 52 men 191 women	painful TMD	non-TMD	DC/TMD	PSQ-9	+	significantly higher levels of depression in the study group, unrelated to gender
De la Torre Canales et al. (2020) ³⁶	N = 737 150 men 587 women	painful TMD	non-painful TMD	RDC/TMD	SCL-90R	+	significantly higher levels of depression in the study group
Reiter et al. (2015) ³⁸	N = 207	chronic TMD	acute TMD	RDC/TMD	SCL-90R	+	significantly higher levels of depression in the study group, additionally, more severe pain and disability
Fernandes et al. (2013) ⁴¹	N = 224	painful TMD	non-painful TMD or non-TMD	RDC/TMD	SCL-90	+	significantly higher levels of severe depression in the study group
Maślak-Bereś et al. (2019) ⁴²	N = 260	TMD subgroups	non-TMD	RDC/TMD	BDI	+	significantly higher levels of depression in patients with painful TMD, no differences between the study groups
Calixtre et al. (2014) ⁴³	N = 116 32 men 84 women	TMD	TMD	RDC/TMD	HADS	+	significant differences found only in the maximum mouth opening without pain and the level of self-estimated mandibular impairment at the time of higher levels of depression
Manfredini et al. (2009) ⁴⁴	N = 96 21 men 75 women	TMD subgroups	TMD subgroups	RDC/TMD	SCL-90R	-	no significant correlation found

TMD – temporomandibular disorders; RDC/TMD – Research Diagnostic Criteria for Temporomandibular Disorders; DC/TMD – Diagnostic Criteria for Temporomandibular Disorders; HADS – Hospital Anxiety and Depression Scale; DASS-21 – Depression, Anxiety and Stress Scale-21; PHQ-9 – Patient Health Questionnaire-9; SCL-90R – Symptom Checklist-90-Revised; SCL-90 – Symptom Checklist-90; BDI – Beck Depression Inventory.

The odds of TMD correlated with the level of trait-anxiety, regardless of age, gender or the level of education. Patients suffering from trait-anxiety at a moderate level were at higher risk of TMD, while severe trait-anxiety doubled the risk.⁵³

In one of the analyzed articles, higher state-anxiety levels correlated with an increased risk of painful TMD⁵³ whereas in another study, they did not.¹⁵ This inconsistency can be easily explained, because, as mentioned before, state-anxiety concerns the momentarily perceived anxiety, which can be influenced by other psychosocial factors, not taken into consideration in either of the presented articles.

Similarly to depression, anxiety does not show any correlation with Axis I diagnosis, leading to the conclusion that the localization of the symptoms is insignificant.^{35,50,53}

There is weak evidence that the level of anxiety tends to decrease significantly after 1 month of treatment, regardless of the type of therapy used (occlusal splint therapy, manual therapy, counseling, or the combination of occlusal splint therapy and counseling).⁵²

Table 2 presents a summary of data regarding anxiety from the most important studies included in the review.

Limitations

The usage of questionnaires as the only diagnostic tools for mental disorders is an important limitation of the included studies. The lack of further psychiatric confirmation may lead to misdiagnosis, biasing the presented results. Furthermore, questionnaires screen only for certain symptoms and do not provide a precise psychiatric diagnosis.

Conclusions

Evidence supporting a correlation between mental disorders, such as depression and anxiety, and TMD is convincing and numerous. The derangements

Table 2. Summary of data regarding anxiety from the most important studies included in the review

Study	Population	Study group	Control group	TMD diagnosing tool	Psychiatric diagnosing tool	Correlation	Conclusion
Giannakopoulos et al. (2010) ¹	N = 222 61 men 161 women	chronic, painful TMD	non-painful TMD, patients without chronic facial pain	RDC/TMD	HADS	+	no significant correlation found
Casanova-Rosado et al. (2006) ³	N = 506	TMD	non-TMD	RDC/TMD	LS	+	significantly higher levels of anxiety in the study group
Monteiro et al. (2011) ¹⁵	N = 150 117 men 33 women	TMD (chronic orofacial pain)	non-TMD	RDC/TMD	STAI	+	significantly higher levels of trait-anxiety in the study group
Cao et al. (2020) ²⁰	N = 830	TMD subgroups	TMD subgroups	RDC/TMD	DASS-21	+/-	significantly higher levels of anxiety only in the chronic, painful TMD subgroup
Simoen et al. (2020) ³⁴	N = 243 52 men 191 women	painful TMD	non-TMD	DC/TMD	GAD-7	+	significantly higher levels of anxiety in the study group, unrelated to gender
De la Torre Canales et al. (2020) ³⁶	N = 737 150 men 587 women	painful TMD	non-painful TMD	RDC/TMD	SCL-90R	+	no significant correlation found
Machado de Resende et al. (2020) ³⁷	N = 120 48 men 72 women	TMD	non-TMD	RDC/TMD	BAI, STAI, HADS	+	significantly higher levels of anxiety in the study group
Reiter et al. (2015) ³⁸	N = 207	chronic TMD	acute TMD	RDC/TMD	SCL-90	-	no significant correlation found
Reissmann et al. (2014) ⁵³	N = 1,208 436 men 772 women	TMD	non-TMD	RDC/TMD	STAI	+	significantly higher levels of anxiety in the study group

LS – Likert Scale; STAI – State-Trait Anxiety Inventory; GAD-7 – Generalized Anxiety Disorder-7; BAI – Beck Anxiety Inventory.

influence the onset of TMD, the course of the disease and a response to treatment. However, the precise role of each mental disorder still requires further clarification.

Screening for mental disorders in TMD patients by means of questionnaires in general dentists' offices is highly recommended.

Depression correlates with TMD; the presence or absence of orofacial pain might be a more important factor than a diagnosis of TMD.

A correlation between anxiety and TMD is rather controversial and depends on various factors, such as the study design, the population under study, the control group, etc. Future studies should focus on investigating the circumstances in which the correlation is significant.

In further research, precise causal relationships should be established between depression, anxiety and TMD, along with defining the prevalence and coexistence of the above-mentioned conditions. A diagnosis of mental disorders should be confirmed by psychiatric examination, not only based on questionnaires.

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