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The association between pain-related factors and psychological distress in patients with temporomandibular disorder

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ABSTRACT

Chronic pain is associated with high levels of psychological distress, which can have implications for general functioning, acceptance, quality of life, and compliance with health-promoting behaviour. This study explored the association between pain-related factors and psychological distress in a sample of patients with long lasting temporomandibular disorder (TMD). In this cross-sectional study design, psychological distress was measured in 133 Norwegian patients with long lasting and severe TMD. Participants completed a survey including the hospital anxiety and depression scale (HADS), and questions about pain intensity, pain duration, catastrophizing, and causal attributions of their TMD symptoms along with a clinical interdisciplinary investigation. Higher levels of catastrophizing were associated with psychological distress. Pain intensity was associated with psychological distress in the unadjusted model, but not when controlling for the other variables. The majority attributed their TMD symptoms to physical factors. The findings support psychological interventions aimed at reducing catastrophizing in treatment of TMD. However, the patients emphasized physical causes for their TMD symptoms, suggesting that psychological interventions alone are not sufficient. The findings support a multidisciplinary approach to the treatment of TMD.

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KEYWORDS
Temporomandibular disorder (TMD); psychological distress; pain intensity; catastrophizing; causal attributions

Temporomandibular disorder (TMD) is a musculoskeletal condition including several diagnoses of muscular facial pain and functional disturbances in the jaw (Scrivani et al., 2008). TMD affects approximately 30% of the general population (Valesan et al., 2021), with a higher frequency in women (Graue et al., 2016). Several studies find high levels of anxiety and depression in TMD patients (Simoen et al., 2020; Sójka et al., 2019).

The current view of TMD emphasizes the biopsychosocial model (Suvinen et al., 2005). Psychosocial distress is a risk factor for onset of acute- and chronic TMD, and can be a cause and a consequence of TMD (Fillingim et al., 2013, 2018).

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Pain-related catastrophizing has been defined as a negative mental set activated by actual or anticipated pain, and is associated with heightened pain intensity, emotional distress, disability and pain-related behaviour (Sullivan et al., 2001).

Anxiety and depression are correlated with increased pain intensity in TMD patients (Su et al., 2017), and to increase with chronic TMD pain (Tjakkes et al., 2010). Moreover, high pain intensity has been shown as a risk factor for poorer recovery three years after an interdisciplinary evaluation (Staniszewski et al., 2022). Identifying the cause of pain is important in chronic pain patients (Dahl & Øverland, 2017). A diagnosis can decrease potential fear of other unrevealed diseases (Malterud, 2010). Pain combined with uncertainty about the cause could increase perception of pain as a threat, fear and pain-related catastrophizing, that potentially maintains both pain and psychological distress (Figure 1).

Aims and research questions

This study investigates the association between psychological distress and pain-related factors in TMD patients.

Materials and methods

The participants (N = 133) consisted of 104 women and 29 men between 19 and 73 years of age (M = 45.1, SD = 13.1).

This cross-sectional study is part of the National TMD project at Haukeland University Hospital. Adults with severe pain, with long term (>1 year) refractory TMD symptoms were included. Patients were examined and diagnosed by six specialists using a beta version of the TMD guidelines (The Norwegian Directorate of Health, 2016). Exclusion criteria were assessed by the general practitioner and included non-TMD-

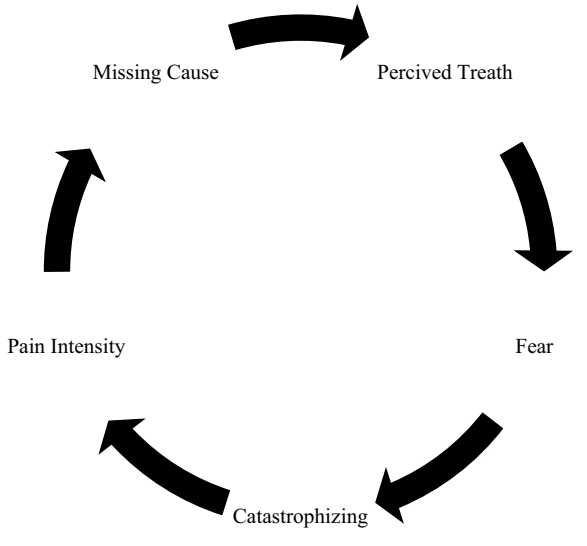

Figure 1. Hypothesis of factors involved in psychological distress in painful conditions like TMD.

related orofacial pain, drug dependency, severe mental illnesses, and unresolved economic disability claims.

Ethical approval was awarded by the Regional Ethical Review Board (2015/930, 2018/647). All participants gave written informed consent. Results of psychological distress, pain duration and catastrophizing (n = 60) have previously been published (Staniszewski et al., 2018; Willassen et al., 2020).

Measures and materials

Psychological distress was measured by Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983). HADS total (HADS-T) has seven statements about anxiety symptoms (HADS-A) and seven statements about depression symptoms (HADS-D), scored on a scale from 0–3. We used a subscale cut-off score of ≥8, to indicate anxiety and depression (Leiknes et al., 2016). α = .89 for HADS-T, = .82 for HADS-A, and = .86 for HADS-D.

Catastrophizing was measured by a two-item version of the Coping Strategies Questionnaire (Jensen et al., 2003). The items 'When I feel pain, it is terrible, and I feel it is never going to get any better' and 'When I feel pain, I feel I can't stand it anymore') were scored from 0–6. The correlation between the items was r = .82. A variable based on the mean score of these items was created.

Pain intensity was measured by averaging participants´ ratings of pain intensity during nights, mornings, late mornings, afternoons, and evenings on a scale from 1–10 (α = .80)

Pain duration was measured by computing the number of years from onset of symptoms.

Causal Attributions for Symptoms is based on analysis of free text answers to the question: 'What do you think has caused your TMD symptoms?'. The answers were divided into 1) no opinion, 2) psychological factors, 3) physical factors, and 4) a combination of physical and psychological factors. To examine the participants' *Confidence in their Attributions*, the answers were coded into one of two categories: explanations with some wording of uncertainty, and explanations without uncertain wording.

Statistical analyses

The associations between psychological distress and the pain-related variables were examined by linear regressions with total HADS as the dependent variable. We estimated separate unadjusted models for each independent variable and then included all independent variables to adjust for covariates.

The percentage of missing values in the independent variables ranged between 0% and 12%. We used multiple imputation to replace missing values (Rubin, 1987) with a two-stage procedure (Von Hippel, 2018) to decide the required number of imputations. This involves first conducting a small-m pilot analysis and then using the information from this analysis in the next step to calculate how many imputations are needed.

In our pilot, the number was set to m = 20 imputation. All variables with missing values were simultaneously imputed by *multivariate imputation using chained equations*

(Van Buuren et al., 1999). For the continuous variables, we used predictive mean matching, and for the single binary variable ('Confidence in causal attribution'), a logistic regression imputation method. We computed a quadratic term to test for a possible curvilinear effect of pain duration on distress. This quadratic term was computed prior to the imputation and imputed along with the other variables. All analyses were performed in STATA version 16.

Results

About 40% reported anxiety levels above the cut-off value for distress, and about 30% for depression (Table 1). Participants reported an average of 12 years with TMD-related pain. 75% attributed their TMD symptoms to physical factors, while 11.5% to psychological factors or a combination. Because of the lack of variation, causal attributions were not included as a predictor in the subsequent regression analysis. Further descriptive statistics and intercorrelations are presented in Table 1 and 2 (Table 2).

Associations between psychological distress and pain-related factors

The two-stage procedure (Von Hippel, 2018) revealed that the imputations $m = 20$ used in our pilot analyses were sufficient.

The unadjusted analysis showed that a 1-unit increase in catastrophizing was associated with a 1.88 increase in distress ($B = 1.88$, $p < .001$). Pain intensity was significantly associated with distress in the unadjusted model, with a 1-unit increase in intensity associated with an 0.99 increase in psychological distress.

Table 1. Descriptive statistics for psychological distress and pain-related factors.

Variables	*M*	*SD*
HADS-T (0–42)	13.54	8.00
HADS-A (0–21)	7.30	4.50
HADS-D (0–21)	6.16	4.33
Catastrophizing (0–6)	3.64	1.40
Pain duration (years)	12.39	9.98
Pain intensity, Total (1–10)	5.57	1.73
Categorical variables	*n*	%
HADS-A caseness[a]	53	39.9
HADS-D caseness[a]	38	28.6
HADS-T caseness[b]	26	19.7
Causal attribution for TMD symptoms		
No opinion	16	13.1
Psychological factors	5	4.1
Physical factors	92	75.4
Combination of psychological/physical	9	7.4
Confidence in attribution		
Some uncertainty	62	50.8
No expressed uncertainty	60	49.2

HADS-T = Total score on the Hospital Anxiety and Depression Scale; HADS-A = HADS Anxiety subscale; HADS-D = HADS Depression subscale

[a]The number of participants scoring above the cut-off score of ≥ 8 on the subscale

[b]The number of participants scoring above the cut-off score of ≥ 8 on both subscales

Table 2. Pairwise correlations (Pearson's r) between all continuous variables included in the study (n = 112–133).

Variables	1.	2.	3.	4.	5.	6.	7.
1. HADS-T	–						
2. HADS-A	.88**	–					
3. HADS-D	.88**	.57**	–				
4. Catastrophizing	.33**	.31**	.32**	–			
5. Pain intensity	.22*	.18*	.21*	.38**	–		
6. Pain duration	−.01	−.06	−.12	−.07	.06	–	
7. Age	.05	.04	.07	.02	.13	.31**	–

HADS-T = Total score on the Hospital Anxiety and Depression Scale; HADS-A = HADS Anxiety subscale; HADS-D = HADS Depression subscale
* $p < .05$. ** $px < .01$.

Table 3. Regression coefficients for associations between pain-related factors and psychological distress.

	Unadjusted				Adjusted			
		95% CI of *B*				95% CI of *B*		
Variable	*B* (*SE*)	LL	UL	β	*B* (*SE*)	LL	UL	β
Sex	−0.95 (1.68)	−4.29	2.38	−.05	−0.32 (1.65)	−3.59	2.94	−.02
Age	.03 (0.05)	−0.08	0.13	.04	0.03 (0.06)	−0.08	0.14	.05
Catastrophizing	1.88*** (0.47)	0.94	2.82	.33	1.62** (0.52)	0.58	2.65	.28
Pain intensity	0.99* (0.40)	0.19	1.79	.21	0.51 (0.44)	−0.36	1.37	.11
Pain duration	−0.10 (0.10)	−0.29	0.10	−.12	−0.09 (0.09)	−0.28	0.11	−.10
Pain duration^2	0.00 (0.01)	−0.01	0.02	.04	0.00 (0.01)	−0.01	0.01	.02
Confidence	−0.48 (1.43)	−3.31	2.34	−03	−0.15 (1.42)	−2.96	2.66	−.01

Sex coded 0 = women and 1 = men; Confidence coded 0 = uncertain and 1 = certain. CI = confidence interval; LL = lower limit; UL = upper limit
* $p < .05$. ** $p < .01$. *** $p < .001$

After adjusting for covariates, the association between catastrophizing and distress remained significant (Table 3). The association between pain intensity and distress was not significant in the adjusted model ($B = 0.51$, $p = .25$). Combined, the independent variables explained approximately 13% ($R^2 = .131$) of the variance. Because of how values of R^2 are distributed, using Rubin's rule to average these measures may not be the most appropriate method. We calculated R^2 using Fisher's r to z transformation (Harel, 2009), which resulted in similar estimates of R^2 and adjusted R^2.

We repeated the analyses using HADS-A and HADS-D as dependent variables. In the unadjusted analyses, catastrophizing was related to both HADS-A ($B = 0.98$, $p < .001$) and HADS-D ($B = 0.98$, $p < .001$), while pain intensity was only related to HADS-D ($B = 0.53$, $p < .01$). The effect of catastrophizing remained significant for both HADS-A ($B = 0.89$, $p < .01$) and HADS-D ($B = 0.83$, $p < .01$) in the adjusted analyses.

Adding a quadratic term to test for possible curvilinear effects of pain duration resulted in non-significant effect.

Discussion

Psychological distress was highly prevalent among TMD patients, which corroborates previous research (Simoen et al., 2020; Sójka et al., 2019). Prior to the National TMD

project, there were no national guidelines regarding diagnosis and treatment, and the responsibility for treatment has been unclear among professions (Rosén et al., 2017; Zakrzewska, 2013). This may have contributed to the high levels of psychological distress. Psychological distress may be an expression of pain and dysfunction, but is also identified as a risk factor for first onset of TMD (Fillingim et al., 2013).

Catastrophizing was associated with psychological distress, corresponding with previous research (Turner et al., 2001). Factor analyses of the Coping Strategy Questionnaire (Rosenstiel & Keefe, 1983), found an overlap between subscales of anxiety, depression and catastrophizing (Sullivan et al., 2001). Other studies indicate that catastrophizing is a separate construct from depression (Keefe et al., 1989; Sullivan et al., 1995, 2001).

Pain intensity was associated with higher levels of psychological distress, but not significant when controlling for other variables. Reciprocal influences of pain-related factors are assumed to contribute to psychological distress among TMD patients (Figure 1). Patients with more pain may have a greater need to find a causal explanation, and lack of confidence in their causal beliefs may increase fear and catastrophizing. Causal certainty did not have a significant effect on psychological distress, nor did pain duration, as previously found (Fillingim et al., 2018; Tjakkes et al., 2010).

The majority attributed their TMD symptoms to physical factors, and about one in ten patients recognized psychological factors. TMD often results in physical limitations and disabilities, which may explain the attributions to physical symptoms. Because of stigma or fear of not receiving adequate treatment, the recognition of psychological factors could be underreported by patients. More research of the biopsychosocial model may contribute to a broader understanding of the complex interplay of these factors, and better treatment of TMD.

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Data availability statement

Extended data that support the findings of this study are available from the corresponding author, Ella Aase Anker; Ella.aase.anker@helse-bergen, upon reasonable request.

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