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Even mild catastrophic thinking is related to pain intensity in individuals with painful temporomandibular disorders

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Abstract

Aims: Temporomandibular disorders (TMD) are often associated with psychological comorbidities. One such comorbidity is pain catastrophising, that is, exaggeration of negative consequences of a painful event. The aim was to investigate catastrophising in individuals with painful TMD compared to controls and the association between catastrophising and pain intensity, number of pain sites and functional limitations.

Methods: A community-based sample of 110 individuals (83 women; 20–69 yrs) with painful TMDs (myalgia/arthralgia as per Diagnostic Criteria for TMD) and 190 age- and gender-matched controls (119 women; 20–69 yrs) from the Public Dental services in Västerbotten, Sweden, participated. Associations between catastrophising and functional jaw limitations, respectively, and painful TMD were evaluated with ordinal regression adjusted for the effect of gender and age. Associations (Spearman's correlation) of the Pain catastrophising Scale (PCS) with Jaw Functional Limitation Scale (JFLS-20), pain site number (whole-body pain map), and characteristic pain intensity (CPI) and intergroup comparisons (Mann-Whitney U test) of these variables were also calculated.

Results: Levels of catastrophising were associated with TMD pain (OR 1.6, 95%CI 1.1–2.6). Among individuals with painful TMD, catastrophising was correlated to pain intensity ($r=0.458$, $p<0.01$) and functional limitations ($r=0.294–0.321$, $p\leq0.002$), but not to number of pain sites.

Conclusion: Compared to controls, community-based individuals with painful TMD demonstrated higher levels of pain catastrophising, and this catastrophising was associated with increased pain intensity and jaw dysfunction. The relatively low scores of pain catastrophising suggest that even mild catastrophic thinking is associated with pain perception and jaw function, and should be considered in patient management.

KEYWORDS

catastrophisation, comorbidity, oro-facial pain, pain catastrophising, temporomandibular disorders

1 | INTRODUCTION

Temporomandibular Disorders (TMD) is an umbrella term for pain and dysfunction involving the masticatory muscles and the temporomandibular joints[1] and is the most common cause of chronic pain in the oro-facial region.[2] The prevalence of TMD pain is approximately 10% in the general population, is more common in middle age, and, as with most other pain conditions, is more common in women.[3,4] In a recent 8-year longitudinal study, it was suggested that the prevalence of TMD is on the increase in young adults, and more so in women.[5]

As with many other pain conditions, psychological comorbidities have been reported in patients with painful TMD. Psychological factors such as stress, depression, anxiety and catastrophising are related to the development, chronification and treatment outcome of pain.[6-8] Importantly, psychological factors have been shown to be of significant importance in chronic pain conditions.[9]

The introduction of the biopsychosocial model[10] has provided a framework for understanding of how not only biological, but also psychological aspects are of importance for the development of persistent pain. In relation to TMD, the biopsychosocial model was one of the cornerstones in the Research Diagnostic Criteria for TMD (RDC/TMD), introduced in 1992.[1] This dual-axis system included Axis I, with well-defined criteria for a TMD diagnosis, in combination with Axis II for psychosocial assessment. To further improve the reliability, validity and clinical utility, the dual-axis system was updated in 2014 as the Diagnostic Criteria for TMD (DC/TMD).[11] The DC/TMD is now the generally accepted gold standard in assessment and diagnosis of TMD and has been advocated in both dental education as well as general and specialist dental practice.[12,13] With the DC/TMD, the psychosocial assessment is provided on two levels, a screening tool and a more comprehensive assessment. With the comprehensive assessment, depression, anxiety and somatisation, but not catastrophising are assessed.

Pain catastrophising is an exaggerated cognitive-affective response to an actual or anticipated painful event or stimuli.[14] It is described in terms of a multidimensional construct including rumination, exaggeration and helplessness. Pain catastrophising has been shown to predict pain intensity, pain disability and outcome of treatment in a range of pain conditions.[15-17] In addition, pain catastrophising has been shown to be related to kinesiophobia, a fear of movement.[18] This may affect the ability to perform tasks such as eating, chewing and communicating. For TMD, the relationship between painful TMD and catastrophising is reported to be of varying degree, possibly affected by comorbidity of pain in other areas of the body, and the relationship with functional limitations of the masticatory system is unclear. Furthermore, most previous studies are based on pain clinic samples, and not community samples with painful TMD.[19] The use of community samples can be advantageous not only when evaluating factors in relation to first onset of TMD[7]and progression of TMD,[20] but also as more representative of the patients generally seen in general dental practice.

The first aim of the present study was to investigate levels and associations of catastrophising in a community sample of adults diagnosed with painful TMD compared with controls. The second aim was to evaluate, in individuals with painful TMD, the association between catastrophising and pain intensity, pain in other parts of the body and jaw functional limitations.

2 | MATERIALS AND METHODS

2.1 | Study setting and participants

This study was conducted within the Public Dental services (PDS) in Västerbotten, Sweden, from January to October 2014, and the source population was based on all adults aged 20 to 69 years who attended at any of the PDS in the region of Umeå or Skellefteå for a routine dental check-up. As part of the check-up, they answered three mandatory screening questions for TMD (3Q/TMD).[21] From this initial sample of 7,831 individuals, participants were randomly invited (random numbers, IBM Corp. SPSS Statistics for Macintosh, Armonk, NY: IBM Corp.), based on age and gender (Figure 1). No other inclusion or exclusion criteria were applied. Subjects continued to be invited until 140 subjects with possible TMD (101 women; 20–69 yrs) and 160 age- and gender-matched controls consented to participate in the study. All participants completed questionnaires and underwent a clinical examination by a single, calibrated examiner (AL) according to the DC/TMD.[11] The STROBE checklist[22] for cross-sectional studies was followed, and the study was approved by the Regional Ethical Board at Umeå university (ref no 2012–331–31 M). All participants signed an informed written consent before participating.

Outcome measures

Painful TMD was considered present when the DC/TMD criteria for myalgia, myofascial pain with referral or arthralgia were fulfilled. The remaining subjects were classified as controls.

Pain catastrophising

The Pain catastrophising Scale (PCS) was used to evaluate the individual level of pain catastrophising.[23] The PCS is a 13-item instrument on thoughts and feelings when experiencing pain on a 5-point scale with endpoints (0) 'not at all' and (4) 'all the time'. The PCS include the elements that in theory encompass catastrophising by three constructs: rumination, magnification and helplessness. The total sum score was calculated from all included items (0–52). A cut-off score of 32 has been suggested appropriate for a clinically significant level of catastrophising.[24]

Pain intensity levels

Characteristic pain intensity (CPI) was assessed from the Graded Chronic Pain Scale (GCPS).[25] In the GCPS, pain intensity is

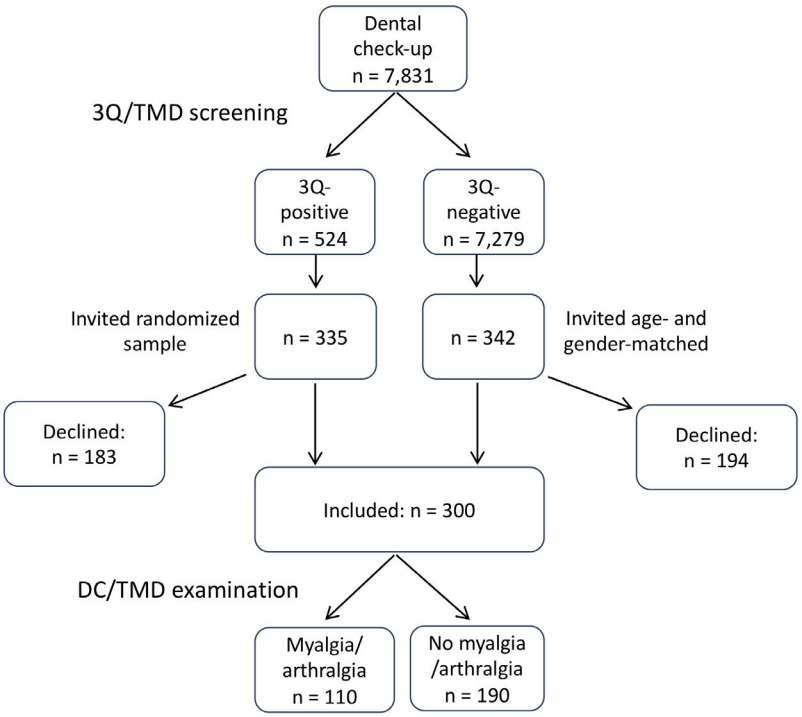

FIGURE 1 Flow chart of study participants

assessed on the numerical rating scale (NRS) (0–10) for current, average and worst pain in the last month. The NRS is a well-established, valid and reliable method for the individual pain intensity level assessed on an 11-point scale with the endpoints: No pain (0) and Worst pain imaginable (10).[26] The CPI was calculated from the GCPS, as the mean score of current, average and worst pain on a 0–100 scale.

Number of painful sites

The number of painful sites in each participant was assessed from a whole-body pain map including pain sites. The extremities and head/face were divided by sides, left and right, whereas neck, abdomen and upper and lower back were each counted once per participant. Based on each participant's drawings, the total number of pain sites was calculated (0–19) ranging from no pain sites (0) to a maximum of 19 pain sites.[27]

Functional limitations

The Jaw Functional Limitation Scale-20 (JFLS-20) was used for the evaluation of the functional status of the masticatory system during the past month. The JFLS-20 is a 20-item, organ-specific instrument covering three constructs: mastication, vertical jaw mobility, and verbal and emotional expression. Each item has an 11-point numerical rating scale from (0) 'no limitation' to (10) 'severe limitation'.[28] No cut-offs are yet provided, and the scale can be used as an ordinal measure at a global level or for the individual constructs. The total sum score for each construct in the JFLS-20 was calculated: mastication (0–60), vertical jaw mobility (0–40), and verbal- and emotional expression (0–100).

2.2 | Statistical methods

Descriptive statistics (median, interquartile range (IQR) and mean (SD)) were used to characterise the study population. Intergroup comparisons of variables were calculated using a non-parametric approach (Mann-Whitney U test).

The association of level of catastrophising and functional limitation among individuals with painful TMD when compared to controls was evaluated with ordinal logistic regression by using an ordinal proportional odds model.[29]The level of catastrophising (PCS) and functional jaw limitations (JFLS), respectively, was used as the dependent (outcome) variable and presence of a painful TMD as independent (predictor) variable. In addition, the model was adjusted for the effect of the matching variables of gender and age. To allow for a non-linear effect, age was modelled using restricted cubic splines with three nodes placed at the 10^{th}, 50^{th} and 90^{th} percentile of the age distribution. The proportional odds assumption was examined and verified by estimating the odds ratio between groups when dichotomising the PCS and the JFLS sum at different cut points across the scale.

In individuals with painful TMD, associations between PCS total score and characteristic pain intensity (CPI), and the number of pain sites were evaluated with Spearman's correlation. In addition, the association between PCS and the scoring in the individual constructs in the JFLS-20 was also analysed using Spearman's correlation.

All statistical analyses were conducted in SPSS (IBM Corp., Released 2019., IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp) and in R (R v4.0.3, R Core Team). A p-value of <0.05 was regarded as statistically significant.

3 | RESULTS

In total, of the 300 subjects who were included, 110 individuals (83 women and 27 men; mean age 37.4, SD 14.1) were diagnosed with painful TMD (myalgia, myofascial pain with referral or arthralgia) (Table 1) and the remaining 190 subjects were classified as controls. There was no significant difference in age between individuals with painful TMD and controls (Mann-Whitney U test; 9,365.0, p=0.134).

Whilst catastrophising scores were low in both the TMD pain and the control group, individuals with painful TMD reported higher levels of catastrophising compared to controls (Figure 2), and an increase in level of catastrophising was associated with TMD pain compared to controls (OR 1.62, 95% CI 1.1–2.6), after adjusting for the effect of gender and age.

The median CPI among individuals with painful TMD was 36.7 (IQR 34.2) and among controls was zero (IQR 6.7). The median number of pain sites was 8 (IQR 7.25) for individuals with TMD pain and 2 (IQR 5.25) for the controls. Among individuals with TMD pain, the level of catastrophising was positively correlated with CPI (r=0.458, p<0.01) (Figure 3) but not to the number of reported pain sites (r=0.020, p=0.835) (Figure 4).

Individuals with painful TMD reported higher levels of functional limitations compared to controls (Table 1), an increase in level of functional limitations was associated with TMD pain compared to controls (OR 8.59, 95% CI 5.3–13.9), after adjusting for the effect of gender and age. Among individuals with painful TMD, the level of catastrophising was positively correlated with functional limitations within all three domains (mastication, vertical jaw mobility, and verbal- and emotional expression; r=0.294–0.321, p≤0.002) (Figure 5).

4 | DISCUSSION

The main finding in the present study was a higher level of catastrophising in a community sample diagnosed with painful TMD compared to controls, which was associated with pain intensity and limitations in jaw function, but not to the number of pain sites. This is one of very few studies to demonstrate this association in a community sample.

The Pain catastrophising Scale is the most commonly used tool for the assessment of levels of catastrophising, and has been found to have good validity together with reliability for the total scores, but not for its subscales.[30] The levels of catastrophising in the present study were generally low. For non-TMD individuals, the reported levels were within normal reference cut-offs, and within the range of pain-free control groups in other TMD studies.[19] For the painful TMD individuals, the levels of catastrophising in the present study were similar to those reported by Chen 2012.[31] Of note are other studies that report higher catastrophising levels in TMD patients, albeit with large variations between study samples.[19] However, most of these other studies were based on pain clinic samples and not, as the present study, on a community sample with painful TMD. We considered a multivariable regression model to assess the relationship between factors associated with the level of pain catastrophising. However, we deemed multivariable analysis not appropriate because of the limited sample size and that the assumptions for linear regression modelling were not met.

The low catastrophising levels in the TMD subjects in the present study could be attributed to factors relating to differences between community-based and clinical samples. This can include differences related to care-seeking behaviour, that has been shown to be related to levels of catastrophising, with catastrophising therefore expected to be considerably higher in clinical samples.[32] It is also possible that cultural differences can affect reporting; lower levels of catastrophising have been found in Denmark, a neighbouring country culturally similar to Sweden, compared to Australia.[33] The individuals in our study were recruited from a randomised sample of patients visiting a dental clinic for a routine dental check-up during 2014. In Sweden, about 80% of adults, with an equal distribution between the genders, attend such routine check-ups, and in the county of Västerbotten about half of these, do so in the public dental health services. The

TABLE 1 Characteristics† of the study population (n=300)

	Painful TMD (n = 110)	Controls (n = 190)	Total (n = 300)
Women (%)	83 (75.5)	119 (62.2)	202 (67.3)
Age, mean (SD)	37.4 (14.1)	39.4 (13.5)	37.0 (23)
Pain catastrophising‡	10.5 (13)	7.0 (12)	8.0 (14)
Pain intensity levels	36.7 (34.2)	0 (6.7)	6.7 (33.3)
Number of painful sites	8 (7.25)	2 (5.25)	4 (7)
Functional limitations§	12 (35)	0 (3)	1 (12)
Mastication	4 (14)	0 (0)	0 (4)
Vertical jaw mobility	3 (10)	0 (0)	0 (4)
Verbal and emotional expression	3 (12)	0 (0)	0 (3)

†provided as medians with interquartile range within parenthesis;
‡data missing for 2 individuals;
§data missing for 1 individual.

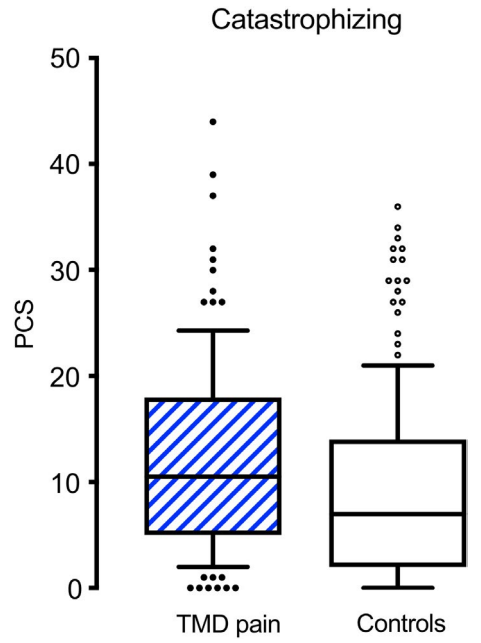

FIGURE 2 Levels of catastrophising on the Pain catastrophising Scale (PCS) for the TMD pain group (n = 110) and controls (n = 190)

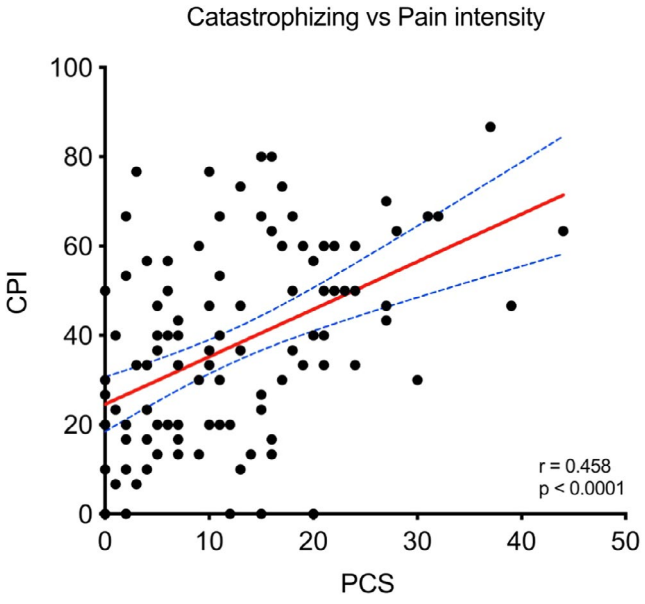

FIGURE 3 Scatterplot of the correlation between the level of catastrophising on the Pain catastrophising Scale (PCS) and Characteristic Pain intensity (CPI) for the TMD pain group (n = 110)

age demographics for the patients in the present study are a representative population sample.[4]

The significant moderate correlation between pain catastrophising and pain intensity, found in the present study, is in line with other studies in patients with TMD pain[34,35] and studies in patients with other pain conditions.[16,36] It has been suggested that the helplessness dimension of catastrophising is responsible for this correlation.[37] In addition, helplessness was also suggested to

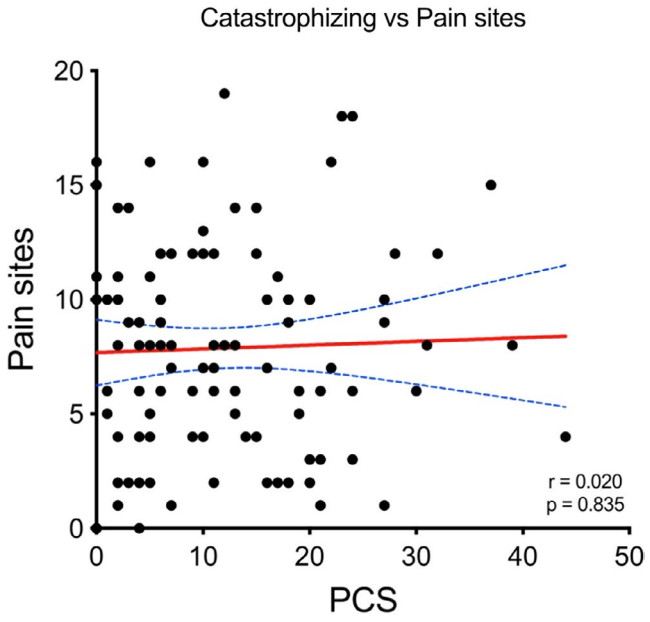

FIGURE 4 Scatterplot of the correlation between the level of catastrophising on the Pain catastrophising Scale (PCS) and the number of reported pain sites for the TMD pain group (n = 110)

be responsible for the correlation with activity limitations, such as the jaw function limitations reported in our study. Pain catastrophising, pain intensity and kinesiophobia have been reported to be the main predictors of pain-related disability[38] and affect the individual's ability to carry out tasks such as eating, chewing and verbally communicating. Our finding of a weak but significant correlation with catastrophising, for the assessed domains of jaw function: mastication, jaw mobility and communication, is in general agreement with previous studies.[39,40] These studies by Turner and colleagues found stronger correlations between catastrophising and functional limitations than we did, which again may reflect that their findings were based on clinical samples.[39,40] Such functional limitations may, together with the negative impact from pain, accentuate the negative effects on daily living and quality of life, and warrant further studies on the interplay between pain, catastrophising and kinesiophobia.

Although more than half of the individuals with TMD pain in the present study also fulfilled the definition used for widespread pain (> seven pain sites), there was no correlation between the number of pain sites and catastrophising. Higher levels of catastrophising have been reported in TMD patients with pain comorbidities[31] in patients with higher number of chronic overlapping pain conditions[41] and in patients with generalised pain.[30] The lack of correlation in the present study could be related to the fact that the study was based on a population sample rather than a patient sample. Catastrophising has been suggested to be the main predictor for care seeking in relation to both orofacial and spinal pain,[32,42] and therefore, the lack of correlation in the present study may point to a difference between community and patient samples used in these studies. The pain attention behaviour embedded in catastrophic thinking could, however, be a significant

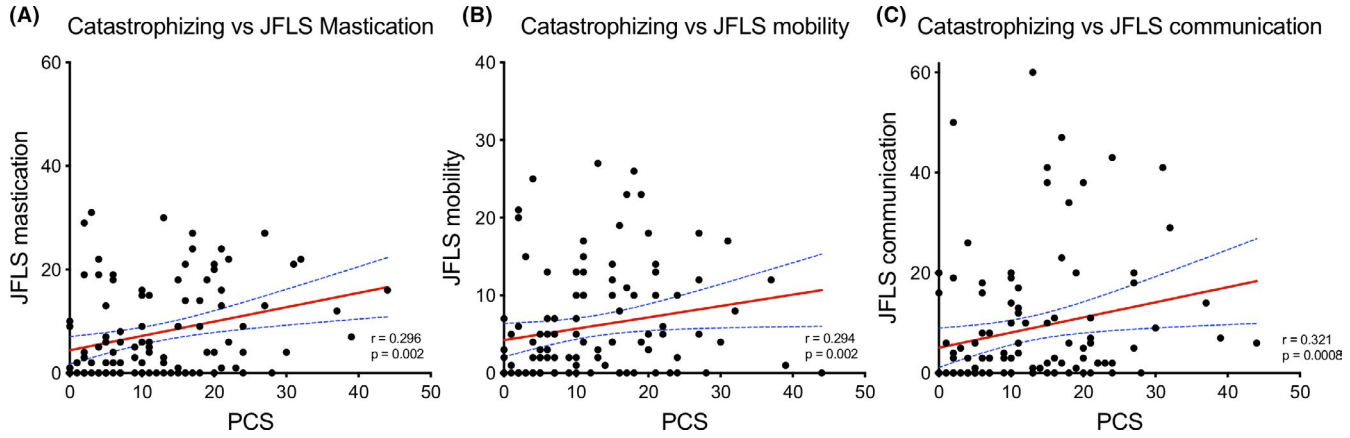

FIGURE 5 Scatterplot of the correlation between the level of catastrophising on the Pain catastrophising Scale (PCS) and functional limitations for the respective constructs: (A) Mastication, (B) Jaw mobility and (C) Communication, of the Jaw Function Limitation scale (JFLS-20) for the TMD pain group (n = 110)

mediator in the transition from acute to chronic pain condition; a hyperalgesic state often associated with widespread pain.[43] In an experimental pain setting, Pressman and co-workers found that in healthy individuals, relatively low levels of catastrophising (PCS 10.6) moderated the association between pain and such secondary hyperalgesia.[44] Therefore, in samples with similar subclinical levels of pain catastrophising such as ours, mild catastrophic thinking may be an early predictor of pain chronification, a notion that warrants further research.

4.1 | Future directions

Catastrophising is related to care-seeking behaviour of TMD patients, such as number of healthcare visits,[39] to chronic pain progression and perseverance[20,45] and to poor treatment outcome. The significance of the relationship between catastrophising and treatment success in patients with TMD is underscored by the effectiveness of CBT in reducing levels of catastrophising as well as improving treatment outcomes.[19] Furthermore, predictors, including central pain sensitivity and body symptoms, of TMD onset and persistence may be mediated by pain catastrophising.[46] Building on these findings and those of the present study, which demonstrates that even low levels of pain catastrophising are associated with increased pain intensity and jaw dysfunction, future studies could not only investigate the effectiveness of the different components of CBT on catastrophising and pain but also on subjects who are transitioning from acute to chronic pain. The ultimate goals could include developing standardised pain management regimens and preventing pain chronicity.

4.2 | Clinical implications

Taken together, the findings from the present and previous studies suggest that evaluation of pain catastrophising can be valuable in the assessment of patients with TMD. At present, catastrophising is not included in the DC/TMD comprehensive Axis II assessment. Given its relation to pain intensity, pain persistence and treatment outcome, it could be considered as an additional measure in patients not responding to initial treatment. This would need to be evaluated in longitudinal studies on the level of catastrophising as the predictor for TMD onset, transition, chronification and outcome of treatment to provide support for the possible incorporation of PCS in future revisions of the DC/TMD. Assessment of levels of catastrophising could guide the clinician when developing tailor-made treatment plans, which may also include referral for CBT as part of a comprehensive multimodal care plan.

In conclusion, from this community sample, those diagnosed with painful TMD reported higher levels of pain catastrophising as compared to controls, albeit with relatively low levels of catastrophising compared to previous studies in patients with TMD. The results also demonstrate an association between pain catastrophising and intensity of pain and jaw dysfunction in individuals with TMD pain. Of note are that the low scores of pain catastrophising in the present study sample suggest that even mild catastrophic thinking can influence pain perception and jaw function and should be considered in patient management.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

AL, BHH, FL, CV, BL and AW contributed to the conception and design of the study. AL carried out the data collection and performed the analysis. BHH and AL drafted the manuscript. All authors contributed to the interpretation of data, critically revised the manuscript and approved the final version of manuscript.

PEER REVIEW

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DATA AVAILABILITY STATEMENT

Data are available from the corresponding author upon reasonable request.

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