**Catastrophising, pain self-efficacy and acceptance in patients with**

**Burning Mouth Syndrome**

 Running head: Catastrophising, pain self-efficacy and acceptance in BMS

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**Conflict of Interest**

The authors have no conflict of interests to declare.

**Abstract**

Background: Little is known about pain catastrophising, pain self-efficacy and chronic pain acceptance in burning mouth syndrome (BMS) and their effect on health-related quality of life (HRQoL) and symptoms of anxiety and depressive disorders.

Objectives: To describe pain catastrophising, pain self-efficacy and pain acceptance in BMS patients and explore associations with affective function and HRQoL.

Methods: A cross-sectional study of 36 BMS patients (31 female) referred to an Orofacial Pain Clinic completed the Pain Catastrophizing Scale, the Pain Self-Efficacy Questionnaire and the Chronic Pain Acceptance Questionnaire-8 in addition to standardised self-reported questionnaires measuring mood and oral and generic HRQoL.

Results: Pain catastrophising levels were markedly higher than (nonclinical) population norms, with 32.0% of patients reporting clinically relevant levels. Pain self-efficacy and chronic pain acceptance varied widely; 24.0% evidenced low confidence to cope with pain and 53.8% reported low activity engagement and/or low pain willingness. Catastrophising showed moderate-to-strong associations with measures of anxiety (*r*=0.63), depression (*r*=0.80), and oral (*r*=0.61) and generic HRQoL (*rho*=-0.84). Self-efficacy and acceptance were also closely related to levels of depression (*r/rho*=-0.83 to -0.73) and generic HRQoL (*r/rho*=0.74 to 0.75). These associations were stronger than those between pain severity and affective function/HRQoL and persisted after controlling for pain severity.

Conclusions: A substantial proportion of BMS patients evidence maladaptive beliefs about personal effectiveness in managing pain, which is closely related to affective disorders and impaired HRQoL. As such, treatment approaches targeting catastrophising, pain self-efficacy and acceptance may prove beneficial in improving mood and quality of life in BMS patients.

**Keywords**: Burning Mouth Syndrome, Orofacial Pain, Pain Catastrophizing, Pain Self-efficacy, Pain Acceptance, Psychological Function, Quality of Life

**1. Introduction**

Burning mouth syndrome (BMS) is a chronic idiopathic or primary orofacial pain condition, defined by the International Headache Society as ‘an intraoral burning or dysaesthetic sensation, recurring daily for more than 2 hours/day over more than 3 months, without clinically evident causative lesions’.1 The condition has previously been known as glossodynia, glossopyrosis, oral dysaesthesia or stomatodynia. It is thought to affect 1.5-5.5% of the general population, most commonly post-menopausal women.2,3 Typically, patients report symptoms of burning, but they may also report tingling, stinging and in some cases numbness. The burning experienced is usually bilateral and the anterior part of the tongue is most commonly affected area followed by the lips. Pain is often present throughout the day with varying intensities and can also disturb sleep.4 The burning may also be accompanied by reported dryness, altered or metallic taste.2,5 Burning mouth symptoms can be induced by several local or systemic conditions (a phenomena previously known as ‘secondary BMS’); local conditions include salivary gland dysfunction, allergies or oral infections such as candidal infections while systemic causes include diabetes or nutritional deficiencies.2 Burning mouth syndrome is diagnosed only when all local and systemic causes have been excluded, however.6

 The pathophysiology of BMS remains incompletely understood. A strong role for neuropathic mechanisms is now widely accepted, with both peripheral (e.g., atrophy of small-diameter nerve fibres in the epithelium) and central (e.g., changes in brain network-related mood and pain modulation following depletion of neuroprotective steroids) neuropathies implicated.7 Accordingly, somatosensory function in patients with BMS is often abnormal, prompting a recent classification to distinguish between BMS with and without somatosensory changes.6 There is also a prominent role for psychological factors.5,8,9 BMS is frequently linked to anxiety, depression and stressful events. A recent review and meta-analysis by Galli and colleagues8 identified anxiety and depression as being the most commonly linked psychological conditions to BMS, with evidence of evaluated risks of anxiety and depression in patients with BMS (compared with matched healthy controls) across pooled studies. The condition has also been shown to affect the health-related quality of life (HRQoL) of patients negatively when compared to healthy controls;10 this, unsurprisingly, includes impaired oral health.11 The management of BMS symptoms, most obviously pain but also psychological correlates, has proved challenging, with no definitive treatment guidelines and little evidence for efficacious treatment approaches.12

Accumulating evidence indicates that, across a range of chronic pain conditions, pain-specific psychological constructs can account for the comorbidity of chronic pain with affective disorder symptoms and for the association between pain experience and impaired HRQoL or pain-related disability. These include pain catastrophising - an exaggerated negative orientation toward pain stimuli and pain experience,13,14 pain acceptance - the ability to engage in life goal activities that include pain while refraining from attempts to reduce contact with that pain,15,16 and self-efficacy to cope with pain.17 It is surprising then that despite the long-held and ongoing interest in the relationship between affective dysfunction and BMS,8,9,18 few studies with BMS patients have examined beliefs about personal capacities to cope with or adapt to chronic pain and their association with patient mood and symptom management. A small number of studies have reported that pain-specific psychological variables including catastrophising, pain anxiety and pain hypervigilance influence pain severity, pain interference and oral HRQoL in BMS,4,19-21 suggesting these are important components of patients’ pain experience. However, the association of catastrophising with BMS patient levels of anxiety or depressive symptoms is not clear, and as recently noted by Forssell and colleagues,21 little is known about the resilience aspects of pain in BMS patients, which include pain self-efficacy and chronic pain acceptance. As such, the purpose of this study was to provide a comprehensive examination of beliefs about personal effectiveness in managing or adapting to pain in patients with BMS, and explore the relationships of catastrophising, chronic pain acceptance and pain self-efficacy with affective (dys)function and oral and generic HRQoL.

**2. Materials and methods**

2.1 Study design

This was a cross-sectional, clinical study of patients with burning mouth syndrome (BMS) who attended the Orofacial Pain Clinic at a South London hospital between April 2016 and January 2019. Patients provided written informed consent, giving permission for their anonymised data to be used for this study. Ethical approval for the study was provided by National Research Ethics Service Committee, London Dulwich (No.15/L0/1108).

2.2 Participants

Thirty-six patients diagnosed with BMS were included. All clinical assessments were carried out by either Oral Surgery or Oral Medicine consultants and included intra- and extraoral examinations. Diagnosis of BMS was based on the classification by the International Headache Society, which describes criteria of pain, itching, or burning in the mouth present daily and persisting for most of the day, with apparently normal oral mucosa and absence of local and systemic diseases.1 The absence of secondary causes of BMS was confirmed by evaluating clinical findings in the oral cavity, and performing laboratory investigations (e.g., blood and/or candida tests) and imaging procedures (e.g., radiography) as required. Patients with disorders that would impair the ability to complete self-report measures, such as psychotic disorders or dementia, were not eligible for study inclusion. Patients who were taking antidepressants, anxiolytics, anticonvulsants, and/or psychotropic medications were included, however.

2.3 Data collection

Patient data from clinical assessments were collected retrospectively from corresponding clinic letters and included information about diagnosis, symptomatology, co-morbid conditions and sociodemographic characteristics. Patients also (prospectively) completed standardised questionnaires assessing pain severity and sensory symptoms, pain catastrophising, pain self-efficacy, chronic pain acceptance, mood, and generic and oral HRQoL. Questionnaires were always self-completed, either manually at the clinic appointment, via post, or electronically using IMPARTS (an initiative funded by King’s Health Partners to “integrate mental and physical healthcare in research, training and clinical services”).22

2.3.1 Measures of pain symptoms and severity

Current pain intensity and average and strongest pain during the past 4 weeks were measured using the 11-point numeric rating scales (NRS) of the PainDetect Questionnaire (PDQ).23 On the same questionnaire, patients rated the severity of seven neuropathic pain descriptors on a 6-point scale ranging from 0(‘never’) to 5(‘very strongly’). Although the validity of the PDQ as a screening tool in BMS remains unclear, it has previously been used to identify neuropathic symptoms in this clinical group.24

2.3.2 Catastrophising, pain self-efficacy and chronic pain acceptance

The frequency with which individuals’ perceived pain as catastrophically threatening was measured using the pain catastrophizing scale (PCS),25 a 13-item questionnaire that employs an ordinal 5-point response scale ranging from 0(‘not at all’) to 4(‘all the time’) for each item, yielding a maximum possible score of 52. The PCS is made up of three subscales; rumination (tendency to attend to pain stimuli), magnification (overestimate their threat value) and helplessness (underestimate the ability to handle that threat), and has good psychometric properties.25 Catastrophising is typically low in healthy populations; a large nonclinical community sample (*n*=215) in a PCS validation study had a mean (SD) score of 13.9 (10.1).26 Clinically relevant catastrophising is determined by a PCS cut-off score of ≥30.25

The confidence BMS patients had in performing daily activities such as socialising, hobbies, and household chores as well as coping without medication was assessed with the Pain Self-Efficacy Questionnaire (PSEQ).27 A 6-point scale, ranging from 0(‘not at all confident) to 6(‘completely confident’), was used for 10 items yielding a possible score range from 0-60, with higher scores indicative of greater pain self-efficacy levels. The PSEQ is a well-established measure in chronic pain and has previously been employed in studies of patients with neuropathic orofacial pain.28,29

The extent to which BMS patients perform activities while experiencing pain and associated experiences (Activities Engagement) and the degree of effort put into controlling pain (Pain Willingness), was assessed using the Chronic Pain Acceptance 8-item Questionnaire (CPAQ-8). Each item is responded to on a 7-point scale ranging from 0(‘never true’) to 6(‘always true’) and allows for calculation of an overall score as well as Activity Engagement and Pain Willingness subscale scores. The CPAQ-8 has shown the same factor structure as the earlier developed 20-item version, with good reliability and validity.30 The number (proportion) of patients showing low pain willingness and/or low activity engagement was identified based on the raw score cut-offs (≤12 and ≤11, respectively) developed in Rovner et al. ’s recent cluster classification study (intended to provided clinically useful behavioural/functional profiles in patients with chronic pain syndromes).31

2.3.3 Affective function and health-related quality of life

Levels of depression and anxiety were measured using the 9-item Patient Health Questionnaire (PHQ-9)32 and 7-item Generalised Anxiety Disorder (GAD-7)33, respectively. Both scales use a 4-point ordinal frequency scale ranging from 0(‘not at all’) to 3(‘nearly every day’). Higher scores on both PHQ-9 (range=0-27) and GAD-7 (range=0-21) indicate more severe symptoms. Both have been shown to be valid and reliable32,33 and have been used in orofacial pain research.28 A small number of (IMPARTS) patients completed the PHQ-2 and GAD-2, whereby the first two questions on each measure were asked and the following questions were only completed if patients responded affirmatively to either of the initial two items (i.e., scored ≥2).

Oral HRQoL was measured using the Oral Health Impact Profile (OHIP-14).34 The questionnaire consists of 14 items addressing several aspects of oral health including functional limitation, physical pain, physical disability, social disability, psychological discomfort and handicap, with each item responded to on a 5-point ordinal frequency scale: 0-‘never’, 1-‘hardly ever’, 2-‘occasionally’, 3-‘fairly often’ and 4-‘very often’. A total score is calculated out of 56, with a higher score reflecting greater impact. An extent score can also be calculated by how many times individuals respond ‘fairly often’ or ‘very often’. The OHIP-14 has been shown to be a reliable, precise and valid measure of oral health,34 with norms available for the UK dentate population.35

Generic HRQoL was assessed using EQ-5D-5L,36 a widely used measure addressing mobility, self-care, usual activities, pain/discomfort and anxiety/depression domains and valid for use in patients with chronic orofacial pain.37 Each item is rated on a 5-point ordinal scale, ranging from 1(‘I have no problems’) to 5(‘I have extreme problems’), indicating present level of health in the relevant domain. An overall health state valuation can be calculated according to a norm-based value set recently developed for England populations,38 with scores ranging from extreme problems in all domains to no problems in any domain (-0.285-1.000). Patients also rate their ‘overall health today’ using a vertical visual analogue scale ranging from 0(‘worst’) and 100(‘best’).

2.4 Statistical analysis

Means (*M*) and standard deviations (SD) were calculated for continuous variables and questionnaire scales and frequencies and percentages for categorical (predominantly demographic and clinical) variables. To evaluate associations between pain-related measures (e.g., severity, pain catastrophising), and indicators of mood and HRQoL, Pearson correlation coefficients and Spearman’s *rho* were calculated according to the distributional properties of the data. Partial correlations (parametric and non-parametric) controlling for pain severity were subsequently administered for significant bivariate correlations. To control for possible Type I errors due to multiple tests of associations, the false discovery rate approach was applied to the set of correlations with control set to 5%.21 Associations between questionnaire scale scores and demographic and clinical characteristics measures were explored using Pearson correlation coefficients (and Spearman’s *rho*) and independent groups *t*-tests. Where continuous data in group comparisons did not closely approximate a Gaussian distribution (evaluated using skewness and kurtosis estimates), bootstrapping (bias-corrected and accelerated; based on 2000 bootstrap samples) was employed to calculate mean differences and associated *P* values. In these (exploratory) analyses, the criterion for statistical significance was set at *P*<0.05. Statistical analyses were completed with SPSS, Version 25.0 (SPSS,IBM).

**3. Results**

3.1 Sociodemographic and clinical profile of BMS patients

The demographic and clinical characteristics of participating BMS patients are provided in Table 1. An overwhelming majority were female, with most aged between 40 and 70 years. Time since onset varied between 1 and 5 years, with a little over 80% diagnosed 12 or more months prior to questionnaire completion. Most patients exhibited continuous and bilateral symptoms, although in those who had lateralised symptoms, they tended to be on the right side.

[Insert Table 1 about here]

As expected, burning was the symptom most commonly reported by patients with BMS (those that did not specifically state ‘burning’ reported symptoms consistent with intraoral dysaesthetic sensations such as ‘pricking’ or ‘tingling’). A quarter of patients reported experiencing tingling as part of their condition. The tongue was the most common site, although almost half the patients experienced symptoms on their palate. Between a third and a half of patients with BMS reported symptoms of dysgeusia and/or xerostomia, while 4 patients reported scialorrea. Stress or fatigue were the most commonly reported BMS symptom-provoking factors, but some patients noted that symptoms were worse in the evening and/or exacerbated by certain foods. A majority of patients were receiving anti-depressant and/or sedative medication, almost all as part of treatment for BMS (tricyclic antidepressants, 23/24; selective serotonin/serotonin-norepinephrine reuptake inhibitors, 2/4; benzodiazepines, 5/5), while almost 30% were taking an anti-epileptic (e.g., Pregabalin). A quarter of BMS patients also presented with another orofacial pain condition, most commonly headaches or migraines. Chronic bodily pain was also present in approximately 25% of patients, and more than 40% of patients were diagnosed with (other) serious medical conditions such as hypertension, diabetes, hypothyroidism, multiple sclerosis, epilepsy, hiatus hernia, cardiovascular disease, and/or malignancy. A quarter of patients had a current or previous depressive and/or anxiety disorder.

3.2 Pain severity and sensory symptoms

Pain severity and associated psychological function data for the BMS patient sample are shown in Table 2. Pain intensity varied widely across patients; more than a third reported moderate levels (4-6) of (7-day) average pain (9,36.0%) while almost half of the patients indicated severe levels (≥7; 12,48.0%). Four out of five patients (20,80.0%) reported their strongest pain in the last week was severe.

[Insert Table 2 about here]

The frequency of neuropathic sensory disturbances regarded as clinically significant (i.e., ‘strongly’ or ‘very strongly’ on the PDQ) for BMS participants is shown in Figure 1. More than two-thirds of BMS patients indicated clinically relevant burning while half reported clinically significant prickling sensations. Interestingly, almost a fifth of patients experienced significant allodynia, while smaller numbers showed clinically relevant levels of (electric shock) attacks, pain in response to cold or hot stimuli, numbness sensations, and pain in response to (slight) pressure.

[Insert Fig 1 about here]

In the current sample, the CPAQ-8, PCS and PSEQ demonstrated good-to-excellent internal consistency (Cronbach's α = 0.87, 0.91 and 0.93, respectively). Pain catastrophising levels were considerably greater than those observed in the nonclinical sample of a PCS validation study26 with marked pain rumination and feelings of helplessness. One third of patients (8,33.3%) evidenced clinically relevant catastrophising levels (i.e., PCS ≥3025). Overall, self-efficacy for coping with pain in the BMS sample was in the mid-to-moderate range; about one fifth of patients (5,20.8%) scored 30 (scale midpoint) or less, reflecting low confidence to cope with pain. Chronic pain acceptance varied widely across the sample although levels of activity engagement (doing valued activities despite the presence of pain) tended to be greater than disengagement from efforts to control or avoid pain (pain willingness). According to the cluster analysis classifications of Rovner et al,31 more than half of BMS patients (13,52.0%) reported low activity engagement (≤12) and/or low pain willingness (≤11), with 3 (11.5%) patients experiencing both. Pain severity (PDQ 7-day average pain) was moderately associated with pain catastrophising (*r*=0.51, *P*=0.014) and chronic pain acceptance (*r*=-0.53, *P*=0.009), but the correlation with pain self-efficacy was not significant (*r*=-0.40, *P*=0.063). However, pain-specific psychological constructs were highly interrelated; pain catastrophising was significantly (negatively) associated with both pain self-efficacy (*r*=-0.77, *P*<0.001) and chronic pain acceptance (*r* =-0.80, *P*<0.001) and the latter two were also closely related (*r*=0.83, *P*<0.001). All 8 patients with clinical levels of pain catastrophising showed either low activity engagement and/or low pain willingness and all patients with low pain self-efficacy evidenced clinical levels of catastrophising.

3.3 Affective function and HRQoL

Data concerning affective function and HRQoL for the BMS sample are shown in Table 3. Of the 11 patients completing measures electronically, 7 did not respond affirmatively to the first two items of the PHQ-9 and GAD-7, indicating an absence of (or mild) symptoms, and did not complete remaining items (and were not considered in the relevant summary and associative data of continuous scores in Table 3 and Table 4). Including these patients, approximately a third of patients reported depressive symptoms levels that were moderate-to-severe (≥10; 11,32.4%),32 while more than a fifth evidenced moderate-to-severe (≥10; 7,21.9%) levels of anxiety.33 Mean OHIP-14 severity indicated diminished oral health in BMS patients compared to the UK dentate population, with all but 5 patients (24,82.8%) scoring above the upper 90th percentile value (17).35 Responses of ‘fairly often’ or ‘very often’ were endorsed by patients, on average, for 6 OHIP-14 items, with psychological discomfort (self-conscious, tense) and psychological disability (difficulty to relax, embarrassment), in addition to physical pain, the most problematic domains for patients. Mean health state evaluation scores (0.69, SD=0.28) suggested poor generic health in the BMS sample also, relative to age-matched healthy UK populations (EQ-5D-3L norms range from 0.93 to 0.78 across ten-year cohorts aged 25-75 years39).

[Insert Table 3 about here]

3.4 Relationships between pain characteristics and affective function and HRQoL

The associations of psychological (dys)function (for those with continuous data) and (oral) HRQoL with pain severity and catastrophising, pain self-efficacy and chronic pain acceptance are shown in Table 3. Pain severity, as measured by 7-day average pain, was significantly associated with oral HRQoL only. Pain catastrophising was strongly associated with worse oral and generic health as well as high levels of anxiety and depression; the helplessness and rumination subscales showed particularly close links with psychological and HRQoL indicators. BMS patients’ pain self-efficacy and chronic pain acceptance evidenced moderate negative relationships with PHQ-9 and OHIP-14 measures scores and moderate positive relationships with EQ Health scores but were not significantly related to GAD-7 scores. Of note, all significant associations between indices of catastrophising, pain self-efficacy and chronic pain acceptance and indicators of HRQoL and affective function remained significant when analyses were re-administered controlling for pain severity (i.e., partial correlations) with the exception of the associations between CPAQ-8 Total Acceptance and OHIP-14 and between CPAQ-8 Pain Willingness and EQ Health.

[Insert Table 4 about here]

Demographic and (other) clinical and health-related variables tended to be poor predictors of pain beliefs, affective function and HRQoL in BMS patients. Age was only significantly associated with PCS magnification (*rho*=-0.63, *P*=0.001) and PHQ-9 scores (*r* =-0.37, *P*=0.044), suggesting younger patients tended to magnify the threat of pain more and show elevated depression levels. Duration of BMS only showed (positive) moderate associations with overall catastrophising score (PCS; *rho*=0.53, *P*=0.011) and with the PCS helplessness subscale (*rho*=0.62, *P*=0.003), indicating worse catastrophising in patients who had experienced BMS for longer. There were no significant (sub)group differences across variables for gender, presence of body pain or comorbid medical condition, use of psychotropic medications or use of antiepileptics. Patients with other (chronic) orofacial pain indicated poorer oral health than those with BMS on the OHIP-14 (*M* (SD)=37.43 (12.99) versus *M* (SD)= 25.91 (12.39), *P*=0.043), but did not differ on any other measure. Small numbers in some of the subgroups (e.g., male, use of antiepileptics) may have precluded significant differences on some variables.

**4. Discussion**

This study is the first to examine three interrelated but distinct constructs relating to

beliefs about personal capacities to cope with or adapt to chronic pain in patients with BMS, namely, pain catastrophising, pain self-efficacy, and chronic pain acceptance. The findings highlighted marked disturbances in each for a number of patients with BMS. Across all patients, pain catastrophising, particularly rumination and helplessness, were closely linked to levels of depression and anxiety and to oral and generic HRQoL, while pain self-efficacy and chronic pain acceptance were associated with depression levels and oral and generic HRQoL. These associations were often stronger than those observed between (NRS) pain severity and affective dysfunction or quality of life, and all but two remained significant after controlling for pain severity, suggesting pain-related cognitive appraisals and behaviours are important determinants of psychological well-being and health function in patients with BMS.

 More than 80% of patients in the present study reported 7-day average pain scores ≥4 on the 11-point NRS, indicative of considerable daily suffering and consistent with previous work suggesting that many BMS patients experience substantial (burning) pain for significant periods.40 Similarly, in line with findings of an elevated risk of comorbid depression and/or anxiety in BMS,8,9 almost a third evidenced moderate-to-severe levels of depression and a little under a quarter reported moderate-to-severe levels of anxiety. HRQoL was also reduced in BMS patients. This was particularly evident for oral health, where OHIP-14 scores indicated oral dysfunction on a greater scale than in previous studies with BMS patients.11,20 Differences may be attributable to longer symptom duration of the present sample or that the OHIP-14 measure is sensitive to impaired psychological and behavioural characteristics of oral function,11 which was marked in study patients. The prevalence of headache and chronic bodily pain in the present sample was in line with those in previous studies of BMS patients.41

Observed pain catastrophising levels were, as a whole, in line with the BMS sample of Lee et al4, although less than that reported in the BMS studies of Rogulj et al20 and Matsuoka et al19. The reason for differences are unclear, especially considering that the average duration of symptoms in this study (30.0 months) - which was moderately associated with pain catastrophising levels - was longer than that in Roguli et al20 (21.9 months) and Matsuoka et al19 (26.3 months) studies, and pain severity levels across studies were not obviously different. Mean PCS scores were (at least numerically) higher than those observed in a study of patients with temporomandibular muscle and joint pain disorders (TMJD),42 suggesting elevated catastrophising levels may be more prevalent in BMS than TMJD. Pain self-efficacy levels across the BMS sample were broadly consistent with those observed in other studies of patients with neuropathic orofacial pain, such as trigeminal nerve injury29 or trigeminal neuralgia.28 Little is known about pain acceptance levels in BMS, or more generally, in orofacial pain disorders. Overall levels of pain acceptance were, however, consistent with those reported in large scale studies of patients with variable chronic pain conditions.43

Pain catastrophising showed moderate-to-strong associations with all measures of emotional function and HRQoL, which persisted even after controlling for the influence of pain severity. This corroborates previous findings of a link between pain catastrophising in BMS and perception of oral health and general well-being,19,20 and more generally, between catastrophising and pain interference,4 and extends these to also suggest an association with affective (dys)function. Literature focussed on the psychological profile of BMS patients has often considered whether or not anxiety and depression cause BMS or occur as a result of the condition.9,18 One study investigating the onset of anxiety and depression in relation to the onset of BMS found that depression and anxiety occurred before BMS in most cases,44 broadly consistent with the idea that steroid dysregulation leading to neurodegenerative changes associated with BMS may be induced by psychological distress.45 It has also been proposed that dopamine dysregulation may increase susceptibility to both depression and impaired pain modulation in BMS.7 The findings here suggest that both depression and anxiety in BMS may also be closely linked to pain catastrophising. Across a range of chronic pain conditions, including orofacial disorders such as TMJD, catastrophising has been consistently associated with negative affect and emotional dysfunction.13,42,43,46 A recent retrospective study of a large number of patients with orofacial pain reported that 34% of the variance in pain interference attributable to psychological distress was mediated by pain catastrophising (after accounting for pain duration and severity), with the strongest effect attributable to the helplessness component.47 Pain catastrophising, particularly helplessness where the strongest correlations in this study were observed, may then be an important element of the distorted pain-related cognitive appraisal processes associated with depression and anxiety in individuals with BMS.

Both pain self-efficacy and acceptance, which were closely related to each other, were significantly associated with levels of depression and oral and generic health in BMS patients. Pain self-efficacy has been linked with depressive symptoms and/or perceived disability in a number of studies with chronic pain patients.17,28 For example, Melek and colleagues28 reported that health status in patients with neuropathic orofacial pain was more closely related to beliefs about capability of coping with pain than measures of pain severity. The benefits of pain acceptance have also been supported by previous studies of patients with bodily chronic pain, with greater levels of acceptance associated with decreased pain-related interference in daily activities, levels of disability and symptoms of depression.15,46,48 In these cases, acceptance is assumed to facilitate better adaptation to chronic pain because attempting to control or avoid the experience of pain is thought to give rise to elevated distress levels and heightened disability.48

High pain catastrophising, low pain self-efficacy and low pain acceptance clustered together in BMS patients, reflecting considerable overlap between pain-related psychological constructs and likely bi-directional flow of effects.15,43,46,49 The precise nature of the role played by pain-related psychological constructs in the relationship between chronic pain experience and affective disorders or impaired HRQoL remains unclear. In one study, Vowles and colleagues demonstrated that pain acceptance significantly mediated the relationship between pain catastrophising and depression, anxiety, and physical and psychosocial functioning.48 More recently, Cheng et al showed that while catastrophising mediates the relationship between pain intensity and depressive symptoms in older people with chronic pain, self-efficacy moderates the relationship between pain intensity and catastrophising, such that the relationship was weaker when self-efficacy was higher.49 The limited sample size in the present study did not allow for assessments of the relative contribution of different pain-related psychological constructs to affective and health function or for specific tests of mediation or moderation. Future studies with larger samples of BMS patients are needed to determine the psychological constructs that are most influential for the relationship between pain symptoms and affective dysfunction and impaired HRQoL.

BMS patient management remains complicated and patients presenting with psychological problems often fail to respond to treatment.5,18 The close associations between maladaptive beliefs about personal effectiveness in managing pain and impaired affective and health in BMS patients observed here suggest that interventions that specifically target catastrophising thinking, increasing confidence to better cope with pain and promoting greater acceptance of (chronic) pain may be a helpful addition to pharmacological and rehabilitative treatments. It is notable that patients with BMS participating in cognitive behaviour therapy (CBT), including approaches specifically focussed on ameliorating pain catastrophising, have experienced improvements in BMS symptoms,50 although the evidence base for these interventions in BMS remains limited.12 There also is a lack of research examining the effectiveness of treatment approaches for BMS that directly target pain acceptance in treatment, such as mindfulness-based treatments or Acceptance and Commitment Therapy.

There were a number of study limitations. While in accordance with other studies of pain beliefs and behaviour in BMS,19,20 the sample size used was small and, as noted above, precluded the use of more complex approaches such as mediation analyses and/or multivariate analyses of factors. Further, the cross-sectional design does not allow causal inferences, although longitudinal research indicating that pain catastrophising and self-efficacy predict chronic pain progression and future disability levels in patients with bodily and orofacial pain13,14 suggests that beliefs about personal effectiveness in managing or adapting to BMS pain may be an important determinant (rather than consequence) of pain experience and health function in BMS patients. Future studies examining affective function and patient well-being at various points after BMS diagnosis, with consideration of pain levels and pain beliefs and behaviours over the same period, may better elucidate the nature of the relationships between beliefs about personal capacities to cope with or adapt to chronic pain and anxiety, depression and impaired oral and general HRQoL.

Clinical data was retrospectively collected, reliant on the quality of records in medical notes, which is imperfect. Also, the sample was heterogeneous, particularly with respect to use of psychotropic and/or antiepileptic medications and presence of comorbid (pain) conditions. Although this reflects the complexity of the BMS clinical population,41 the participants involved in this study were referred to a specialist orofacial pain clinic and as such, likely to have more severe symptoms and be more psychologically distressed with high rates of (psychotropic) medication use, and may not be representative of all BMS patients. Comorbidity can negatively impact both affective function and health in patients with orofacial pain,5 and while antidepressant and benzodiazepine medications are frequently used to treat BMS,7,44 with some evidence for symptom relief,12 their impact on HRQoL and

catastrophising, pain self-efficacy and chronic pain acceptance in this population remain uncertain. In the present study, the presence of a comorbid disorder and medication use were not related to beliefs about personal effectiveness in managing or adapting to pain or to affective and health function, but the sample size is relatively small and risk of Type II errors in these comparisons was high. In addition, routine sensory testing of BMS patients in this cohort was not undertaken at the time of the study, preventing examination of relationships between somatosensory function and pain beliefs. Finally, other factors linked with BMS known to influence psychological function and pain experience, such as sleep,4 taste disturbance5 and cancer phobia,19 were not systematically measured.

**5. Conclusions**

This study identified maladaptive beliefs about personal effectiveness in managing pain in a substantial proportion of patients with BMS, with almost a third of patients reporting clinically relevant pain catastrophising levels, a quarter of patients evidencing low confidence to cope with pain, and more than half showing low activity engagement and/or low pain willingness. Within the context of a cross-sectional study, the strong associations observed between pain catastrophising, and to a slightly lesser degree pain self-efficacy and acceptance, and affective function and HRQoL, suggest that beliefs about personal capacities to cope with or adapt to chronic pain play a critical role in the pain experience and well-being of BMS patients. As such, an optimal approach to treat BMS patients is likely to be one that utilises assessment methods that also provide insight into the patients’ beliefs about their capacity for effective pain management, with those patients experiencing maladaptive pain beliefs identified early in the treatment process and psychological interventions aimed at modifying pain catastrophising, pain self-efficacy and chronic pain acceptance employed accordingly.

**References**

1. ICHD. The International Classification of Headache Disorders, 3rd edition (beta version). *Cephalalgia.* 2013;33(9):629-808.

2. Renton T. Burning mouth syndrome. *Reviews in Pain.* 2011;5(4):12-17.

3. Bergdahl M, Bergdahl J. Burning mouth syndrome: prevalence and associated factors. *Journal of Oral Pathology & Medicine.* 1999;28(8):350-354.

4. Lee GS, Kim HK, Kim ME. Relevance of sleep, pain cognition, and psychological distress with regard to pain in patients with burning mouth syndrome. *Cranio.* 2019:1-9.

5. Kim M-J, Kim J, Kho H-S. Comparison between burning mouth syndrome patients with and without psychological problems. *International Journal of Oral and Maxillofacial Surgery.* 2018;47(7):879-887.

6. ICOP. International Classification of Orofacial Pain, 1st edition (ICOP). *Cephalalgia.* 2020;40(2):129-221.

7. Imamura Y, Shinozaki T, Okada‐Ogawa A, et al. An updated review on pathophysiology and management of burning mouth syndrome with endocrinological, psychological and neuropathic perspectives. *Journal of Oral Rehabilitation.* 2019;46(6):574-587.

8. Galli F, Lodi G, Sardella A, Vegni E. Role of psychological factors in burning mouth syndrome: A systematic review and meta-analysis. *Cephalalgia.* 2017;37(3):265-277.

9. Schiavone V, Adamo D, Ventrella G, et al. Anxiety, depression, and pain in burning mouth syndrome: first chicken or egg? *Headache: The Journal of Head and Face Pain.* 2012;52(6):1019-1025.

10. Lopez-Jornet P, Camacho-Alonso F, Lucero-Berdugo M. Quality of life in patients with burning mouth syndrome. *J Oral Pathol Med.* 2008;37(7):389-394.

11. Adamo D, Pecoraro G, Fortuna G, et al. Assessment of oral health-related quality of life, measured by OHIP-14 and GOHAI, and psychological profiling in burning mouth syndrome: A case-control clinical study. *J Oral Rehabil.* 2020;47(1):42-52.

12. McMillan R, Forssell H, Buchanan JA, Glenny AM, Weldon JC, Zakrzewska JM. Interventions for treating burning mouth syndrome. *Cochrane Database of Systematic Reviews.* 2016(11).

13. Velly AM, Look JO, Carlson C, et al. The effect of catastrophizing and depression on chronic pain–a prospective cohort study of temporomandibular muscle and joint pain disorders. *Pain.* 2011;152(10):2377-2383.

14. Demmelmaier I, Åsenlöf P, Lindberg P, Denison E. Biopsychosocial predictors of pain, disability, health care consumption, and sick leave in first-episode and long-term back pain: a longitudinal study in the general population. *International Journal of Behavioral Medicine.* 2010;17(2):79-89.

15. Kanzler KE, Pugh JA, McGeary DD, et al. Mitigating the effect of pain severity on activity and disability in patients with chronic pain: The crucial context of acceptance. *Pain Medicine.* 2019;20(8):1509-1518.

16. McCracken LM, Eccleston C. A prospective study of acceptance of pain and patient functioning with chronic pain. *Pain.* 2005;118(1-2):164-169.

17. Thompson EL, Broadbent J, Fuller-Tyszkiewicz M, Bertino MD, Staiger PK. A network analysis of the links between chronic pain symptoms and affective disorder symptoms. *Int J Behav Med.* 2019;26(1):59-68.

18. Kim MJ, Kho HS. Understanding of burning mouth syndrome based on psychological aspects. *Chin J Dent Res.* 2018;21(1):9-19.

19. Matsuoka H, Himachi M, Furukawa H, et al. Cognitive profile of patients with burning mouth syndrome in the Japanese population. *Odontology.* 2010;98(2):160-164.

20. Rogulji AA, Richter I, Brailo V, Krstevski I, Boras V. Catastrophizing in patients with burning mouth syndrome. *Acta Stomatologica Croatica.* 2014;48(2):109-115.

21. Forssell H, Teerijoki‐Oksa T, Puukka P, Estlander AM. Symptom severity in burning mouth syndrome associates with psychological factors. *Journal of Oral Rehabilitation.* 2020;47:713-719.

22. Rayner L, Matcham F, Hutton J, et al. Embedding integrated mental health assessment and management in general hospital settings: feasibility, acceptability and the prevalence of common mental disorder. *General hospital psychiatry.* 2014;36(3):318-324.

23. Freynhagen R, Baron R, Gockel U, Tölle TR. Pain DETECT: a new screening questionnaire to identify neuropathic components in patients with back pain. *Current Medical Research and Opinion.* 2006;22(10):1911-1920.

24. Lopez-Jornet P, Molino-Pagan D, Parra-Perez P, Valenzuela S. Neuropathic Pain in Patients with Burning Mouth Syndrome Evaluated Using painDETECT. *Pain Med.* 2017;18(8):1528-1533.

25. Sullivan MJ, Bishop SR, Pivik J. The pain catastrophizing scale: development and validation. *Psychological Assessment.* 1995;7(4):524.

26. Osman A, Barrios FX, Gutierrez PM, Kopper BA, Merrifield T, Grittmann L. The Pain Catastrophizing Scale: further psychometric evaluation with adult samples. *Journal of Behavioral Medicine.* 2000;23(4):351-365.

27. Nicholas MK. The pain self‐efficacy questionnaire: Taking pain into account. *European Journal of Pain.* 2007;11(2):153-163.

28. Melek LN, Smith JG, Karamat A, Renton T. Comparison of the neuropathic pain symptoms and psychosocial impacts of Trigeminal Neuralgia and Painful Posttraumatic Trigeminal Neuropathy. *Journal of Oral & Facial Pain & Headache.* 2019;33(1).

29. Smith JG, Elias LA, Yilmaz Z, et al. The psychosocial and affective burden of posttraumatic neuropathy following injuries to the trigeminal nerve. *J Orofac Pain.* 2013;27(4):293-303.

30. Fish RA, McGuire B, Hogan M, Morrison TG, Stewart I. Validation of the Chronic Pain Acceptance Questionnaire (CPAQ) in an Internet sample and development and preliminary validation of the CPAQ-8. *Pain.* 2010;149(3):435-443.

31. Rovner G, Johansson F, Gillanders D. Cutoff scores for the 8-item version of the Chronic Pain Acceptance Questionnaire (CPAQ-8) to identify different profiles of pain acceptance patterns, levels of function and behavioral flexibility. *Journal of Contextual Behavioral Science.* 2019;14:146-156.

32. Kroenke K, Spitzer RL. The PHQ-9: a new depression diagnostic and severity measure. *Psychiatric Annals.* 2002;32(9):509-515.

33. Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of Internal Medicine.* 2006;166(10):1092-1097.

34. Slade GD. Derivation and validation of a short‐form oral health impact profile. *Community Dentistry and Oral Epidemiology.* 1997;25(4):284-290.

35. Slade G, Nuttall N, Sanders A, Steele J, Allen P, Lahti S. Impacts of oral disorders in the United Kingdom and Australia. *British Dental Journal.* 2005;198(8):489-493.

36. Herdman M, Gudex C, Lloyd A, et al. Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). *Quality of Life Research.* 2011;20(10):1727-1736.

37. Durham J, Steele J, Breckons M, Story W, Vale L. DEEP Study: does EQ‐5D‐5L measure the impacts of persistent oro‐facial pain? *Journal of Oral Rehabilitation.* 2015;42(9):643-650.

38. Devlin NJ, Shah KK, Feng Y, Mulhern B, van Hout B. Valuing health‐related quality of life: An EQ‐5 D‐5 L value set for E ngland. *Health Economics.* 2018;27(1):7-22.

39. Kind P HG, Macran S. . UK Population norms for EQ-5D. Discussion Paper 172: York Centre for Health Economics. *University of York* 1999.

40. Forssell H, Teerijoki-Oksa T, Kotiranta U, et al. Pain and pain behavior in burning mouth syndrome: a pain diary study. *Journal of Orofacial Pain.* 2012;26(2).

41. Moisset X, Calbacho V, Torres P, Gremeau-Richard C, Dallel R. Co-occurrence of pain symptoms and somatosensory sensitivity in burning mouth syndrome: a systematic review. *PloS One.* 2016;11(9).

42. Park J-H, Kim H-K, Kim K-S, Kim M-E. Pain catastrophizing for patients with temporomandibular disorders. *Journal of Oral Medicine and Pain.* 2015;40(2):47-54.

43. Elvery N, Jensen MP, Ehde DM, Day MA. Pain catastrophizing, mindfulness, and pain acceptance. *The Clinical Journal of Pain.* 2017;33(6):485-495.

44. de Souza FT, Teixeira AL, Amaral TM, et al. Psychiatric disorders in burning mouth syndrome. *Journal of Psychosomatic Research.* 2012;72(2):142-146.

45. Woda A, Dao T, Gremeau-Richard C. Steroid dysregulation and stomatodynia (burning mouth syndrome). *Journal of Orofacial Pain.* 2009;23(3).

46. Craner JR, Sperry JA, Koball AM, Morrison EJ, Gilliam WP. Unique contributions of acceptance and catastrophizing on chronic pain adaptation. *Int J Behav Med.* 2017;24(4):542-551.

47. Jang H-H, Kim M-E, Kim H-K. Pain catastrophizing mediates the effects of psychological distress on pain interference in patients with orofacial pain: A cross-sectional study. *Journal of Oral & Facial Pain & Headache.* 2018;32(4).

48. Vowles KE, McCracken LM, Eccleston C. Patient functioning and catastrophizing in chronic pain: The mediating effects of acceptance. *Health Psychology.* 2008;27(2S):S136.

49. Cheng S-T, Leung CM, Chan KL, et al. The relationship of self-efficacy to catastrophizing and depressive symptoms in community-dwelling older adults with chronic pain: a moderated mediation model. *PloS One.* 2018;13(9).

50. Matsuoka H, Chiba I, Sakano Y, Toyofuku A, Abiko Y. Cognitive behavioral therapy for psychosomatic problems in dental settings. *BioPsychoSocial Medicine.* 2017;11(1):18.

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| **Table 1.** Demographic and clinical characteristics of patients with burning mouth syndrome (BMS; *n* = 36). Numbers represent frequency (percentage) unless otherwise stated.  |
| Demographic |  |
|  |  |
| Gender: Female | 31 (86.1%) |
| Age (Mean [SD; Range]) | 55.1 (9.3; 32-73) |
| Clinical |  |
| BMS duration (Months; Median[IQR]) | 30.0 (12.0-60.0) |
| BMS >=12 months | 28 (82.4) |
| Periodicity |  |
| Continuous | 31 (93.9) |
| Intermittent | 2 (6.1) |
| Side affected |  |
| Left | 3 (8.3) |
| Right | 10 (27.8) |
| Both | 23 (63.9) |
| Oral symptoms |  |
| Burning | 32 (88.9) |
| Tingling |  10 (27.8) |
| Numbness | 2 (5.6) |
| Associated features |  |
| Dysgeusia | 15 (41.7) |
| Xerostomia | 12 (33.3) |
| Perceived | 11 (30.6) |
| Actual | 1 (2.8) |
| Scialorrea |  4 (11.1) |
| Itchiness | 2 (5.6) |
| Difficulty swallowing | 1 (2.8) |
| Globus sensation | 1 (2.8) |
| Occlusal dysesthesia | 1 (2.8) |
| Halitosis | 0 (0.0) |
| Site affected |  |
| Tongue | 27 (77.1) |
| Palate | 16 (45.7) |
| Gums |  9 (25.7) |
| Cheeks |  4 (11.4) |
| Lip | 3 (8.6) |
| Provoking factors |  |
| Stress/Tiredness | 14 (38.9) |
| Evening/Later in day | 10 (27.8) |
| Certain foods (e.g., spicy) |  7 (19.4) |
| Brushing teeth/Toothpaste/Mouthwash | 3 (8.3) |
| Certain drink | 1 (2.8) |
| Cold weather | 1 (2.8) |
| Medications (BMS) |  |
| NSAIDs | 3 (8.6) |
| Opioids |  4 (11.4) |
| Anti-epileptics | 10 (28.6) |
| Benzodiazepines |  5 (14.3) |
| Tricyclic anti-depressives | 24 (68.6) |
| SSRI/SNRI anti-depressives |  4 (11.4) |
| Comorbid conditions |  |
| Headache disorder |  5 (13.9) |
| TMJD | 3 (8.3) |
| Other orofacial neuropathy | 2 (5.6) |
| Other (Bodily) Chronic Pain |  9 (25.0) |
| Depressive disorder (historical or current) | 7 (19.4) |
| Anxiety disorder (historical or current) | 5 (13.9) |
| Comorbid Medical Condition(s) | 15 (41.7) |
| Note: IQR = inter-quartile range; All patients with duration data (*n* = 34) had BMS >=6 months; Ethnicity data was available for 19 patients only, 17 who identified as White or White British, 1 as Black African Caribbean and 1 as South American; SSRI = selective serotonin reuptake inhibitors; SNRI = serotonin-norepinephrine reuptake inhibitors; TMJD = temporomandibular muscle and joint pain disorders; Co-medical conditions included (but were not limited to) hypertension, diabetes, hypothyroidism, multiple sclerosis, epilepsy, hiatus hernia, cardiovascular disease, and/or malignancy. There was a small number of missing data on some variables stated percentages and means refer to participants with data available for variable in question. |

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| **Table 2.** Pain severity, catastrophising, pain self-efficacy and chronic pain acceptance in patients with burning mouth syndrome. |
|  | *n* | Mean (SD) |
| Pain severity (PDQ) |  |  |
| Pain now (0-10) | 25 | 5.24 (2.63) |
| Strongest pain (7-day; 0-10)  | 25 | 7.64 (2.27) |
| Average pain (7-day; 0-10) | 25 | 6.12 (2.28) |
| Pain catastrophising |  |  |
| PCS (0-52) | 24 | 22.75 (14.55) |
| Rumination (0-16) | 24 | 8.54 (5.36) |
| Magnification (0-12) | 24 | 3.08 (3.49) |
| Helplessness (0-24) | 23 | 10.74 (7.36) |
| Pain self-efficacy |  |  |
| PSEQ (0-60) | 24 | 42.67 (17.41) |
| Chronic pain acceptance |  |  |
| CPAQ-8 (0-48) | 25 | 29.36 (10.98) |
| Activity Engagement (0-24) | 25 | 18.16 (6.84) |
| Pain Willingness (0-24) | 25 | 11.20 (6.18) |
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Note: *n* values for questionnaires are variable due to the exclusion of a small number of patients’ questionnaire results from analyses because of failure to complete questionnaire or a high (i.e., >10%) number of missing items;‌ PDQ = PainDetect Questionnaire;‌ PCS = Pain Catastrophizing Scale; PSEQ = Pain Self-Efficacy Questionnaire; CPAQ-8 = Chronic Pain Acceptance Questionnaire - 8. |

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| **Table 3.** Affective function and health-related quality of life (HRQoL) in patients with BMS |
|  | *n* | Mean (SD) |
|  |  |  |
|  |  |  |
| Mood |  |  |
| PHQ-9 (0-27) | 27 | 9.41 (8.15) |
| GAD-7 (0-21) | 25 | 8.16 (6.18) |
|  |  |  |
| HRQoL measures |  |  |
| OHIP-14 Severity (0-56) | 29 | 28.69 (13.28) |
| Functional limitation (0-8) | 29 | 1.80 (1.32) |
| Physical pain (0-8) | 28 | 2.64 (1.23) |
| Psychological discomfort (0-8) | 29 | 2.55 (1.26) |
| Physical disability (0-8) | 29 | 1.18 (1.22) |
| Psychological disability (0-8) | 29 | 2.32 (1.35) |
| Social disability (0-8) | 29 | 2.04 (1.37) |
| Handicap (0-8) | 29 | 2.08 (1.20) |
| OHIP-14 Extent (0-14) | 29 | 5.93 (3.91) |
| EQ-Health (-0.285 - 1.000) | 33 | 0.697 (0.284) |
| EQ-VAS (0-100) | 34 | 68.68 (24.99) |
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Note: *n* values for questionnaires are variable due to a small number of patients not completing all measures; PHQ-9 = Patient Health Questionnaire – 9; GAD-7 = Generalized Anxiety Disorder - 7; OHIP-14 = Oral Health Impact Profile-14; EQ-Health = EQ-5D-5L health state evaluation; EQ-VAS = current overall health rating (today); 7 patients completed only the first 2 items of the PHQ-9 and 7 patients completed only the first 2 items of the GAD-7 – these patients scores are not included in the Table.  |

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| **Table 4.** Associations between pain characteristics, HRQoL and affective function in burning mouth syndrome (BMS; *n* = 36) patients. |
| Questionnaire | PHQ-9 | GAD-7 | OHIP Severity | EQ Health |
| PDQ; 7-day Average | 0.41 |  0.10 |  |  **0.48\*** | -0.33 |
| PSEQ  |  **-0.83\*\*\*** | -0.34 |  |  **-0.57\*\*** |  **0.74\*\*\*** |
| PCS |  **0.80\*\*\*** |  **0.63\*\*** |  |  **0.61\*\*** |  **-0.84\*\*\*** |
| Rumination |  **0.66\*\*** |  **0.60\*\*** |  |  **0.62\*\*** |  **-0.63\*\*** |
| Magnification |  **0.55\*** |  0.35 |  | 0.17 |  **-0.48\*** |
| Helplessness |  **0.85\*\*\*** |  **0.70\*\*** |  |  **0.62\*\*** |  **-0.91\*\*\*** |
| CPAQ-8 |  **-0.73\*\*\*** | -0.34 |  | **-0.45\*** |  **0.75\*\*\*** |
| Activity Engagement |  **-0.68\*\*\*** | -0.41 |  |  -0.42 |  **0.76\*\*\*** |
| Pain Willingness |  -0.34 |  0.07 |  |  -0.23 |  **0.47\*** |
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Note: Values presented are Pearson *r* or Spearman *rho* (according to distribution of correlated variables); *n* values for all questionnaires are variable due to the exclusion of a small number of patients’ questionnaire results from analyses because of failure to complete questionnaire or a high (i.e., >10%) number of missing items (including 7 patients who did not respond affirmatively to the first two items of the Patient Health Questionnaire – 9 (PHQ-9) and the Generalized Anxiety Disorder – 7 (GAD-7)); OHIP = Oral Health Impact Profile; EQ Health = EQ-5D-5L health state evaluation; PDQ = PainDetect Questionnaire; PSEQ = Pain Self-Efficacy Questionnaire; PCS = Pain Catastrophizing Scale; CPAQ-8 = Chronic Pain Acceptance Questionnaire - 8. Associations with significance after correction for multiple comparisons are indicated in bold; \**p* < 0.05, \*\**p* < 0.01, \*\*\**p* < 0.001. |

**Figure Legends**

**Fig 1.** Frequency (percentage of BMS patients) indicating clinically relevant problems (i.e., score > 3) on dimensions of neuropathic pain in the PainDetect Questionnaire (*n* = 33).Note: Data labels represent percentages.