



# Stress-related coping styles, anxiety, and neuroticism in university students with myalgia temporomandibular: A case control study

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## Abstract

Patients suffering pain-related temporomandibular disorders (TMD) exhibit greater levels of psychological distress, environmental stress, somatic symptoms, anxiety, depression, pain catastrophizing, and impaired pain coping strategies compared to pain-free controls. However, little is known about psychological factors involved in the different TMD types. Furthermore, regardless of severity or TMD type, the role of stress-related coping strategies and styles in TMD is not yet well understood. The main goal of this study was to investigate stress-related coping styles, anxiety, and personality traits in a group of dentistry students suffering from temporomandibular disorder with myalgia. A cohort of 102 university students was initially recruited for this study. Following clinical evaluation, a myalgia group (24 participants) and a control group (25 participants) were formed. Participants were later assessed in anxiety, stress coping strategies, and personality measures. The myalgia group presented greater levels of trait anxiety and neuroticism in comparison to the control group. Participants with myalgia also showed higher levels of avoidance coping. Avoidance coping strategies are generally considered maladaptive, as they seem to increase perceived stress, a robust predictor of TMD.

**KEYWORDS:** Temporomandibular disorders; Myalgia; Psychological factors; Coping styles; Anxiety; Neuroticism.

## I. Introduction

According to the American Academy of Orofacial Pain's (AAOP) definition, Temporomandibular Disorders (TMD) include a group of musculoskeletal and neuromuscular pathological conditions that involve the Temporomandibular joint (TMJ), the masticatory muscles and all associated tissues (Fernandez de las Penas & Svensson, 2016). While patients with these disorders are also characterized by limited jaw movement and TMJ joint sounds, like clicks or crepitation, the most common complaint is pain, usually localized in the masticatory muscles and the preauricular area. TMD is thought to affect from 10 percent to 30 percent of individuals globally. However, only in 15% of cases, individuals perceive that they need treatment (Kelleher, Ray-Chaudhuri, & Khawaja, 2015). TMD refers to a group of heterogeneous conditions that can be divided into 2 main subgroups: Temporomandibular joint disorders and masticatory muscle disorders. Among the disorders of the masticatory muscles, myalgia (which includes local myalgia, myofascial pain, and myofascial pain with referral) is one of the most frequent in the general population (Schiffman et al., 2014).

Despite the fact that some studies find somatic symptoms to be more strongly associated with TMD onset, psychological variables such as perceived stress or negative effect have also been shown to be significantly associated and predictive of TMD (Fillingim et al., 2013). Thus, currently, TMD cannot be understood without considering the biopsychosocial framework (Darnall, Carr, & Schatman, 2017). Although few studies have explored psychological factors in TMD subtypes, a positive relationship between anxiety, depression, and somatization with chronic myofascial pain (a subtype of myalgia) has been observed (Velly, Gornitsky, & Philippe, 2003). Furthermore, several

studies suggest that certain psychological factors can predispose an individual to TMD (Bonjardim, Gavião, Pereira, & Castelo, 2005; Celić, Pandurić, & Dulčić, 2006). Thus, the well-known OPERA cohort study revealed that somatic symptoms, perceived stress, negative mood, and personality traits such as the neuroticism predicted an increased risk of TMD first onset (Fillingim et al., 2013). In this line, increased risk of developing TMD is more pronounced for individuals whose genetic susceptibility increases responsiveness to catecholamine neurotransmitters (Slade et al., 2015) which are involved in the stress response. However, it has also been shown that painful TMDs can also relate to altered clinical, psychological, and biological factors. Thus, according to the literature, TMD patients experiencing pain present greater levels of psychological distress, environmental stress, somatic symptoms, anxiety, depression, somatic awareness, and pain catastrophizing compared to pain-free controls (Carlson et al., 1993; Fillingim et al., 2011; Quartana et al., 2010; Gatchel, Peng, Peters, Fuchs, & Turk, 2007; Keefe, Rumble, Scipio, Giordano, & Perri, 2004; Fernandes, van Selms, Gonçalves, Lobbezoo, & Camparis, 2015). Therefore, a two-way relationship between TMD and psychological factors has been proposed (Fillingim et al., 2018).

The relationship between pain coping, specifically catastrophizing, and TMD severity has been well investigated (Turner, Dworkin, Mancl, Huggins, & Truelove, 2001). However, the relationship between stress-related coping and TMD is not yet well understood and particularly TMD myalgia (Reissmann, John, Schierz, & Seedorf, 2012; Ferrando et al., 2004; Callahan, 2000). Generally, stress-related coping can be defined as the predictable cognitive and behavioral efforts to manage environmental and internal demands or conflicts (Lazarus, 1985). Although, data point

out that stress-related coping influences perceived stress, the different approaches and models about stress-related coping styles make it difficult to compare findings and extract clear conclusions. Some authors differentiate problem-focused and emotion-focused coping strategies (Lazarus, 1985), while others distinguish between approach- versus avoidance-oriented coping (Suls, 1985), adaptive versus maladaptive coping (Tan, Teo, Anderson, & Jensen, 2011), and active versus passive coping (Gatchel, Turk, 2006; Brown, & Nicassio, 1987). However, in general, it seems problem-focused, active coping and approach-oriented coping can be regarded as adaptive, whereas emotion-focused, passive and avoidance-oriented coping can be considered maladaptive (Reissmann et al., 2012).

Taking the later in account, previous research pointed out that people suffering TMD showed more maladaptive stress-related coping responses in comparison to controls (Reissmann et al., 2012; Ferrando et al., 2004; Callahan, 2000). Specifically, TMD patients use more escape-avoidance strategies, less problem-solving strategies, minor positive reinterpretation and humor as coping strategies, and show lower interest in seeking instrumental social support. Studies have confirmed that a passive attitude, exaggeration of negative consequences, and reduced use of distraction strategies constitute a dysfunctional style of coping, which is associated with greater levels of distress in TMD patients (Turner et al., 2001). Therefore, maladaptive coping might lead to an increase of perceived stress and consequently to an increased risk of suffering TMD.

Furthermore, oral health-related quality of life in myalgic patients appeared to worsen with coping strategies that reveal passive or avoidant attitudes of the patient (Hasanoglu Erbasar & Al-

paslan, 2019). In contrast, it has also been reported that TMD patients with pain primarily in the masticatory muscles score higher on the active coping scale than patients with arthrogenic pain, (Kight, Gatchel, & Wesley, 1999; Galdon et al., 2006). Altogether, this data shows that it is not yet well understood the relation between stress coping and TMD, particularly in myalgic patients, calling for further study.

Indeed, different perspectives and assessments regarding coping have led to a variety of results and interpretations. The relationship between pain coping and TMD has been well explored (Turner et al., 2001). However, stress-related coping has been less investigated. Nonetheless, perceived stress, which is a strong predictor of TMD (Fillingim et al., 2013), is negatively related to adaptive coping strategies. These results are in line with the classical model of Lazarus and Folkman (1985), in the sense that the way people perceive a stress situation might be related with their coping capabilities. Taking all together, it seems necessary to clarify the relationship between TMD and stress-related coping styles. In addition, most studies investigating coping behavior are focused on just one dimension of coping (such as active versus passive coping, or approach versus avoidance behavior), while few studies explore multiple coping responses and styles.

Furthermore, only a few studies have considered the role of psychological factors when considering the different TMD types according to the DC/TMD criteria. Few of them have focus either on arthralgia or myalgia (Velly et al., 2003), while previous evidences indicate that the role of coping styles and psychological factors might be different for these TMD types (Ferrando et al., 2004; Galdon et al., 2006). A more systematized approach, using valid and reliable coping questionnaires able

to explore and quantify several coping strategies is needed to clarify the role of stress-related coping in TMD. Myalgia is the type of TMD in which psychological factors and coping styles might be more involved, when compared to other TMD types (Hasanoglu Erbasar & Alpaslan, 2019; McCreary, Clark, Merrill, Flack, & Oakley, 1991).

Therefore, the main propose of this study was to investigate the role of coping in myalgia. To this aim levels of anxiety, stress-related coping style, and personality were compared between a university student group presenting myalgia (according to the DC/TMD) and a control group free of symptoms.

According to previous finding, it is expected that the myalgia group and the control group will differ significantly in terms of their coping strategy pattern, anxiety, and neuroticism.

## II. Methods

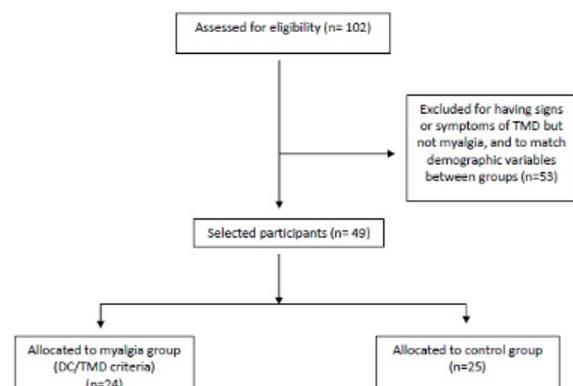
### Participants

For the purpose of this research, a multivariate case-control study was conducted. A total of 102 volunteer students from the Faculty of Odontology at Complutense University of Madrid, both male (N=25) and female (N=77) ranging from 18-35 years old (mean age 21), were recruited for this study. Participants were included in the study after giving their written informed consent according to the Declaration of Helsinki and approved by the ethics committee of the "Hospital Clínico Universitario", UCM, Madrid, Spain (Reference: 12/043-E)". Data from a total of 49 participants was analyzed, as the other 53 participants did not meet the classification criteria for the myalgia group but presented some minor sign/symptoms or were excluded

in order to match demographic variables (gender, age, ethnicity, etc) between groups (see Figure 1). That is to say, control group was composed of healthy participants that did not present any signs or symptoms of any TMD type and case group was composed by participants that clearly fulfilled DC/TMD criteria for myalgia. Therefore, two groups of participants were formed, matched in terms of demographic variables.

The myalgia group (N=24, 4 males) included students that were clinically diagnosed with myalgia, and was further subdivided into three DC/TMD types: (1) local myalgia (N= 5), defined by the DC/TMD as "pain localized to the site of palpation"; (2) myofascial pain (N=16), defined as "pain spreading beyond the site of palpation but within the boundary of the muscle being palpated"; and (3) myofascial pain with referral (N=3), defined as "pain at a site beyond the boundary of the muscle being palpated" (Schiffman et al., 2014). Only 3 out of 24 myalgic participants have request professional help and used occlusal splint regularly. The control group (N=25, 7 males) consisted of students who did not show any signs nor symptoms of any type of TMD.

Figure 1: Consort-scheme of participant selection and eligibility criteria



### Instruments

In order to evaluate the participants' oral history, they were administered the TMD Pain Screener and the Symptom Questionnaire by the Diagnostic Criteria (DC/TMD) Axis I evaluation (Schiffman et al., 2014). A questionnaire regarding demographic data was also administered (i.e. gender, age, ethnicity, family income).

The evaluation of psychological factors included anxiety, stress coping and personality measurements. Anxiety was assessed using the State-trait anxiety inventory (STAI), which includes 20 items for assessing trait anxiety (STAI-T) and 20 for assessing state anxiety (STAI-S) (Spielberger, Gorsuch, & Lushene, 2011). Stress coping was measured using the Coping Responses Inventory—Adult Form (CRI), which contains 48 items grouped into 8 scales: Logical Analysis, Positive Reappraisal, Seeking Guidance and Support, Problem Solving, Cognitive Avoidance, Acceptance or Resignation, Seeking Alternative Rewards and Emotional Discharge (Moos, 2010). These 8 scales are classified according to two dimensions identified in the literature: Cognitive and Behavioral coping on the one hand, and Approach vs. Avoidance coping on the other hand (see Table 1). Lastly, personality was assessed by the Neo Five-Factor Inventory (NEO-FFI), a 60-item measure of the five major domains of personality: Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness. Evidence of convergent and discriminant validity is presented in the NEO-PI-R manual (Costa & McCrae, 2008). All the selected tests are validated for a Spanish sample and are commonly used in research (Bartkowska, Samborski, & Mojs, 2018) and have high levels of reliability (Cronbach alphas between 0,59 and 0,93) and validity (correlations generally above 0,70). A blind correction of the questionnaires was

carried out by two psychologists specialized in health psychology and psychological assessment, who were blind to the experimental conditions.

	APPROACH COPING	AVOIDANCE COPING
COGNITIVE COPING	<b>Logical Analysis</b> e.g. Thinking about different solutions	<b>Cognitive Avoidance</b> e.g. Avoiding thinking about the problem
	<b>Positive Reappraisal</b> e.g. Trying to see the bright side of the problem	<b>Acceptance or Resignation</b> e.g. Accepting that nothing can be done.
BEHAVIORAL COPING	<b>Seeking Guidance and Support</b> e.g. getting help of expert counselors	<b>Seeking Alternative Reward</b> e.g. Looking for alternative distractions.
	<b>Problem Solving</b> e.g. Deciding on and implementing a solution	<b>Emotional Discharge</b> e.g. Crying, grieving

Table 1: Coping Response Inventory (CRI) scales (Moos, 2010) according to coping dimensions. Examples are given base on CRI specific questions.

### Procedure

First, participants were administered the TMD Pain Screener, the Symptom Questionnaire by the Diagnostic Criteria (DC/TMD) Axis I evaluation (Schiffman et al., 2014), and the demographic questionnaire.

After completing the questionnaires related to participants' oral history, two dentists performed oral examinations of TMD signs and symptoms using the DC/TMD Examination protocol. They were carried out in the dentistry faculty at Complutense University. The examination included TMJ palpation, masticatory muscles palpation and assessment of opening movement patterns and joint sounds like clicks or crepitation.

Dentists were adequately trained in the DC/TMD protocol at the "temporomandibular disorders and orofacial pain" magister (University Complutense of Madrid). A preliminary calibration was performed between the 2 dentists to check the inter-rater reliability, resulting in a good degree of agreement, expressed by a Kappa index of 0.76.

Following the oral examinations, the partici-

participants included either in the myalgia group or in the case one (see subjects' section for details about group composition) were called back two weeks later to complete the psychological questionnaires. After receiving instructions by two psychologists, they filled out the questionnaires at the same time in a quiet environment. Although no time limit was set, it took participants around 45 min on average to complete all the questionnaires. Both oral examination and questionnaires were scheduled so that they were administered outside of university exam periods.

#### Statistical analyses

Sample size was initially calculated with the method described in Naing, et al. (2006), assuming a Myalgia TMD prevalence of 15% in the general population (Kelleher et al. 2015), a level of confidence of 0.95 and a precision of 0.1. Sample size calculation resulted in 25 subjects per group, that is a total of 50 participants. Additionally, taking in account that the study is multivariate, to better estimate sample size adequacy for each variable the power ( $\theta$ ) for each one was calculated (table 2).

Statistical analyses were calculated using SPSS 24 Statistics Software (IBM) and R, including the package MVN for Mardia's multivariate analysis (Korkmaz, Goksuluk, & Zararsiz, 2014). First at all, data were standardized by calculating the t-scores ( $M = 50$ ,  $sd = 10$ ) of each scale within each questionnaire. Items multivariate normality was assessed via Mardia's multivariate kurtosis and skewness coefficients (Mardia, 1970). Second, one-way multiple variable analyses of variance (MANOVA) was performed, where the group (myalgia vs controls) was the intersubject factor and the dependent variables were the scales of each test. To fulfill the assumption of independence, a second MANOVA was calculated, excluding

CRI strategies, but including the type of strategy (Cognitive, Behavioral, Approach, and Avoidance coping), since the later are combinations of different strategies (see Table 1). This type of analyses was chosen, because one of its benefits is to control for Type 1 error than might occur by conducting multiple t-tests. Furthermore, as explained above, effect size (partial eta squared:  $\eta^2_p$ ) and power ( $\pi$ ) were calculated for each variable included in the MANOVA. In addition, a logistic regression analysis was performed.

## Results

### MANOVA Analyses

The estimates of Mardia's multivariate kurtosis and skewness coefficients were non-significant, 0.01,  $p = .994$ , and 721.37,  $p = .132$  respectively, therefore granting a parametric MANOVA for the analyses.

In regard to anxiety measurements, results from the one-way MANOVA revealed higher levels of trait anxiety in the myalgia group in comparison to the control group ( $F(1,47) = 4.46$   $p = .04$ ,  $\eta^2_p = .087$ ,  $\pi = .544$ ), while for state anxiety no significant effects were observed (see Table 2 for detailed results including non-significant ones).

Additionally, analyses of NEO-FFI data indicated that the level of neuroticism was, on average, higher for the myalgia group in comparison to the control group ( $F(1,47) = 6.39$   $p = .015$ ,  $\eta^2_p = .120$ ,  $\pi = .698$ ). No significances were observed in the other variables of this questionnaire.

Lastly, with respect to coping measurements, the findings showed that the myalgia group presented significantly higher levels of Acceptance and Resignation ( $F(1,47) = 4.21$   $p = .046$ ,  $\eta^2_p = .082$ ,

$\pi = .521$ ) and Seeking Alternative Reward ( $F(1,47) = 5.69$   $p = .021$ ,  $\eta^2 p = .108$ ,  $\pi = .647$ ) in comparison to the control group. Regarding the type of strategy, to fulfill independence assumption, a separate MANOVA including type of strategies (Cognitive, Behavioral, Approach, and Avoidance coping), but not the strategies themselves was calculated. Significant differences were observed exclusively

for Avoidance coping ( $F(1,47) = 8.58$   $p = .005$ ,  $\eta^2 p = .154$ ,  $\pi = .819$ ). Overall, the myalgia group presented larger use of avoidance strategies than the control group. No significances were observed in the other variables of this questionnaire.

	Group	Mean	Standard deviation	Percentile score	$E_{[1,47]}$	Sig.	Effect size ( $\eta^2 p$ )	Power ( $\pi$ )
Anxiety Trait	Myalgia	48.82	8.91	55	4.46	.04	.087	.544
	Control	44.38	5.44	30				
Anxiety state	Myalgia	47.32	7.31	50	1.46	.23	.030	.220
	Control	44.94	6.39	40				
NEO - Neuroticism	Myalgia	53.12	2.29	60	6.39	.01	.120	.698
	Control	51.64	1.8	55				
NEO - Extraversion	Myalgia	50.58	3.71	50	.37	.54	.008	.092
	Control	51.12	2.27	55				
NEO - Openness	Myalgia	50.21	2.34	50	1.05	.31	.022	.171
	Control	49.48	2.61	45				
NEO - Agreeableness	Myalgia	47.08	4.43	40	2.7	.11	.054	.364
	Control	48.76	2.47	45				
NEO - Conscientiousness	Myalgia	48.75	2.64	45	.005	.94	.000	.051
	Control	48.8	2.38	45				
CRI - Logical Analysis	Myalgia	49.45	9.64	45	1.65	.20	.034	.243
	Control	46.36	7.07	35				
CRI - Positive Reappraisal	Myalgia	50.08	9.01	50	.000	.98	.000	.050
	Control	50.04	7.45	50				
CRI - Seeking Guidance and Support	Myalgia	52.46	11.21	60	.029	.86	.001	.053
	Control	53	10.9	60				
CRI - Problem Solving	Myalgia	49.92	7.92	50	1.01	.32	.021	.167
	Control	47.28	10.19	40				
CRI - Cognitive Avoidance	Myalgia	53.21	9.01	60	1.65	.20	.034	.242
	Control	49.68	10.14	50				
CRI - Acceptance or Resignation	Myalgia	56.67	12.39	70	4.21	.04	.082	.521
	Control	50.12	9.8	50				
CRI - Seeking Alternative Reward	Myalgia	52.92	14.89	60	5.69	.02	.108	.647
	Control	44.64						

	Control	8.71	30					
<b>CRI - Emotional Discharge</b>	Myalgia	50.75	8.54	50	1.54	.22	.032	.230
	Control	47.92	7.36	40				
<b>Cognitive coping</b>	Myalgia	52.35	6.72	60	3.76	.058	.074	.477
	Control	49.05	5.11	45				
<b>Behavioral coping</b>	Myalgia	51.51	7.13	55	3.97	.052	.078	.497
	Control	48.21	4.11	45				
<b>Approach coping</b>	Myalgia	50.48	6.86	50	.55	.46	.012	.113
	Control	49.17	5.41	45				
<b>Avoidance coping</b>	Myalgia	53.38	6.98	60	8.6	.005	.154	.819
	Control	48.09	5.61	45				

Table 2: STAI, NEO and CRI multiple analyses of variances (MANOVAs) including effect size and power. Average percentiles for university students have been also included according to the questionnaire's manual (Spielberger et al., 2011; Costa & McCrae, 2008; Moos, 2010).

### III. Resultados

#### *Logistic regression*

Logistic regression analyses were then conducted to examine the interdependence of Anxiety-trait, Neuroticism, and Avoidance coping variables in their association with TMD. The full model was significantly reliable ( $\chi^2(3) = 11,73, P = .008$ ), this model accounted for between 21.3 and 28.4 of the variances in TMD status with the 74,5% of the participants successfully predicted. Only Avoidance coping significantly predicted TMD status (odds ratio = 1.12, 95% CI = 1.08 – 1.16,  $P = .03$ ).

#### **Discussion**

Out of 102 university students initially considered, 24 of them suffered from myalgia (myalgia group) and 25 participants did not have any TMD-related symptom or signs (control group). When comparing anxiety, personality and coping variables between groups, the myalgia group presented greater levels of trait anxiety and neuroticism in comparison to the control group. In addition, par-

ticipants with myalgia also showed higher levels of Acceptance and Resignation as well as Seeking Alternative Rewards, and in general they used significantly more often avoidance coping strategies, which was the only reliable predictor of TMD according to the logistic regression model.

The simplest result of this study is that out of the 102 individuals initially considered, 24 of them suffered from myalgia which formed the myalgia group, although the majority of these participants did not consider it severe enough to request professional help. Only 25 participants did not present any TMD-related symptom or signs. It should be noted that the participants were university students (a specific subgroup of young adults) and a more representative sample would have increased the study validity. Nevertheless, the percentage of students suffering TMD matches population prevalence suggested by other studies (Ferrandes et al, 2015; Calixtre, Grüniger, Chaves, & Oliveira, 2014; Lövgren, Österlund, Ilgunas, Lampa, Hellström, 2018; Karthik, Hafila, Saravanan, Priyadarsini, Ashwath, 2017; Huhtela et al., 2016). Furthermore, participants average score of the psychological questionnaires were similar

to other Spanish university students according to norms provided by questionnaire manuals (Spielberger et al., 2011; Moos, 2010; Costa & McCrae, 2008), since percentiles were within 40 and 60 (see Table 2), except for anxiety trait and just one of the CRI coping strategy, logical analyses (30 and 35, respectively). In addition, the sample selection (a cohort of university students) favored the homogeneity of the samples in terms of age, sociological, cultural and environmental variables. Nonetheless, it should be taken into account that even though the myalgia group clearly fulfilled the diagnostic criteria, they weren't severe patients seeking consultation. The fact that psychological alterations are already present in non-severe patients would support their importance in chronic and more severe TMD patients.

In accordance with previous studies in TMD, the myalgia group showed higher levels of trait anxiety than the control group (Fillingim et al., 2013; Velly et al., 2003; Bair et al., 2016). However, while the OPPERA prospective cohort study detected significantly larger levels of trait and state anxiety for TMD patients (Fillingim et al., 2013), in the present study state anxiety differences were not significant. This might be due to a high level of homogeneity between the myalgia and control groups, a cohort of university students, which were probably facing similar social and environmental demands. Alternatively, this could also be due to a lack of power resulting from the number of participants, since data analyses for anxiety scores revealed small size effects and powers. In addition, the present sample included participants suffering exclusively from myalgia. According to the present data, higher anxiety levels in myalgia might appear mainly because of the individuals' traits, regardless of the situation, at least for young adult students.

A relationship between TMD and the Neuroticism personality trait has been previously observed (Moayed et al., 2011). In the same line the OPPERA study showed that it is at least a predictor of TMD (Fillingim et al., 2013), however it did not differentiate between articular and muscular TMD pathologies. In the studies in which the differences between muscular TMD and articular TMD are analyzed, differences appear. Thus, Ferrando et al. (2004) showed that myofascial patients present higher levels of neuroticism, whereas conscientiousness and self-discipline were higher in the articular group. Similarly, the present findings show that myalgic participants have larger levels of neuroticism than controls. It should be considered that personality is a psychological construct developed during the childhood-adolescence which is quite stable throughout life (Damian, Spengler, Sutu, & Roberts, 2019), therefore it might be scarcely affected by the course of a disease. Taken the later in account, these results suggest that neuroticism might be an important personality factor contributing to TMD, at least for myalgia. Nonetheless, although neuroticism is often considered a stable personality trait depending on genetic and environmental factors (Briley, & Tucker-Drob, 2014), emotionally focused therapies, such as the unified protocol for the treatment of emotional disorders (Osma et al., 2018), might be useful to prevent TMD.

Coping styles were thoroughly investigated by means of the CRI inventory in the present study. The myalgia group used avoidance coping strategies significantly more often. Particularly, Acceptance and Resignation as well as Seeking Alternative Rewards were more prevalent in myalgia group than in the control group. Furthermore, according to the logistic regression model, Avoidance Coping is the best and only significant predictor of TMD. Therefore, it could be said that myalgic

patients, in comparison to controls, tend to face a problem by looking for distractions, avoiding the problem and accepting that they can do nothing to solve it. Avoidance coping strategies are often regarded as maladaptive. Furthermore, maladaptive coping is related to depression and anxiety (Sugawara et al., 2012). TMD patients seem to cope with stress differently than individuals from the general population. In line with the present findings, an increase of escape-avoidance strategies for TMD patients has been previously described, which were interpreted as maladaptive (Reissmann et al., 2012; Callahan, 2000). In this line, a recent study found that avoidance and passive coping strategies might worsen oral health-related quality of life in patients with myalgia (Hasanoglu Erbasar & Alpaslan, 2019). In contrast, some studies have observed higher levels of active coping in masticatory muscle pain patients in comparison with articular pain patients (Kight et al., 1999; Galdon et al., 2006; Carver, Scheier, Weintraub, 1989), although a symptomless control group was not included, making comparisons harder to establish. In contrast to previous research, the present study did not identify reduced adaptive coping strategies in the myalgia group. It should also be considered, however, that the participants were young students presenting myalgia, unlike previous studies, where the lack of adaptive coping strategies might well appear as a consequence of long lasting and more severe TMD and/or aging. Nonetheless, the differences in the assessment and definition of coping strategies across the few studies in the literature that assess coping in TMD make similarities hard to establish.

The way people face problems or stressful situations and the way in which they interpret them, may play a role in TMD, particularly in myalgia. Our data appears compatible with this hypothesis, as it indicated larger levels of avoidance/maladaptive

coping styles in myalgic patients in comparison to the control group. In addition, it was the only reliable predictor of TMD according to the logistic regression model. The well-known OPPERA study investigated pain coping, but not stress-related coping strategies. However, they established that perceived stress increased the risk of first onset TMD (Fillingim et al, 2013; Slade et al., 2016). Specifically, maladaptive coping strategies might increase perceived stress, a strong predictor of TMD (Enns, Eldridge, Montgomery, & Gonzalez, 2018; Por, Barriball, Fitzpatrick, & Roberts, 2011), thus playing a role in TMD. Therefore, intervention programs including techniques to promote the use of adaptive coping strategies, reduce maladaptive ones and foster emotional stability, which is related with neuroticism trait, may be useful to prevent the development of temporomandibular myalgia.

The present study points out that coping styles might be related with myalgia, although several limitations should be addressed in future research. A sample of dentistry students guarantees, on the one hand, the accuracy of symptoms detection (because of their symptoms awareness, and their knowledge about them), and on the other hand, it also equalized, educational level, similar environment and lifestyle between myalgic participants and controls. However, as discussed above, case group included young students presenting myalgia, even though they clearly fulfilled the diagnostic criteria, they weren't severe patients seeking consultation. Therefore, further research including patients and a larger and more heterogenic sample of people could enhance the generalizability of the results. In addition, psychological factors, including depression, emotional intelligence and catastrophizing among others, should be investigated taking into account the TMD subtypes proposed by the new DC/TMD classification.

## Conclusions

University students diagnosed with myalgia showed higher levels of neuroticism, trait anxiety, and avoidance coping style in comparison to the symptomless individuals in the control group. The results support the hypothesis that participants with myalgia and controls differ significantly in terms of their coping strategy pattern, anxiety and neuroticism. In light of the results and considering that avoidance coping was the only reliable predictor of TMD and it is related to the increase of perceived stress, interventions to reduce anxiety and stress levels, together with maladaptive coping styles management and prevention, might improve temporomandibular health. In addition, taking in account the larger neuroticism levels, emotionally focused therapies, such as the unified protocol for the treatment of emotional disorders, might also help prevent TMD myalgia. However, further research is required in myalgia which includes other psychological factors, such as emotional intelligence, in larger and more heterogeneous samples.

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