

Coping styles in myalgic university students: A case control study.

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Abstract

Background: Patients suffering pain related temporomandibular disorders (TMD) exhibit greater levels of psychological distress, environmental stress, somatic symptoms, anxiety, depression, somatic awareness, pain catastrophizing, and pain coping strategies compared to pain-free controls. However, little is known about psychological factors involved in the different TMD types fulfilling DC/TMD criteria. Furthermore, regardless of the severity, the role of general coping strategies and styles in TMD is not yet well understood. The main goal of this study was to investigate anxiety, personality traits, and coping behavior in a group of dentistry students suffering from temporomandibular disorder with myalgia. **Methods:** 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 by using the State-trait anxiety inventory (STAI), coping response inventory (CRI), and Neo Five-Factor Inventory (NEO-FFI) questionnaires respectively. **Results:** The myalgia group presented greater levels of trait anxiety and neuroticism in comparison to the control group. In addition, participants with myalgia showed higher levels of avoidance coping. **Conclusions:** Avoidance coping strategies are generally considered maladaptive, as they seem to increase perceived stress, a robust predictor of TMD. Interventions to reduce stress levels and prevent maladaptive coping styles, might improve temporomandibular health and prevent the myalgia and its chronification.

Background

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 [1]. 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. Depending on psychological factors, muscle pain, which is a source of minor inconvenience for some patients, can become a major health problem for others, even if there is no physical change differentiating these two types of patients.

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 [2–7]. Although, few studies evaluated the effects of psychological factors on myalgia, higher level of anxiety, depression, and somatization have been associated to chronic myofascial pain [8]. Regarding personality factors, TMD patients show higher levels of neuroticism than controls [9].

Furthermore, several studies suggest that certain psychological factors can predispose an individual to TMD. The well-known OPPERA cohort study revealed that somatic symptoms, perceived stress, and negative mood predicted and increased risk of TMD first-onset [10,11]. Furthermore, increased risk of

developing TMD is more pronounced for individuals whose genetic susceptibility increases responsiveness to catecholamine neurotransmitters [12] which are involved in stress response. According to this model, much smaller contributions were made from psychological stress, anxiety, obsessive-compulsive feelings, and pain-coping strategies (including catastrophizing). Neuroticism has also been linked to increased rates of TMD, although it may be a weak predictor of TMD [3,13]. Both global psychological and somatic symptoms emerged as the most robust risk factor for the incidence of TMD [12,14]. Along these lines, Su et al. [14] observed that the best predictor for TMD pain intensity was somatisation, while depression was the best predictor of pain-related disability. More recently, follow-up of the OPPERA study observed that psychological and social variables are closely related and change in parallel with TMD status [16]. These findings indicate that multiple underlying psychological constructs are present and are important to consider as potential risk factors for TMD.

Although the OPPERA study highlighted the importance of psychological factors on TMD and effectively explored many important ones (including passive vs. active pain coping), the relationship between TMD and general coping strategies was not included [16]. Nonetheless, as described above, perceived stress is a solid predictor of TMD [13,14,17], and is negatively related to both emotional intelligence and to adaptive coping strategies. Therefore, maladaptive coping might lead to an increase of perceived stress and consequently to an increased risk of suffering TMD.

The influence of coping strategies in health has been widely studied [18]. Generally, coping can be defined as the predictable cognitive and behavioral efforts to manage environmental and internal demands or conflicts [19]. Nonetheless, interpretations of findings can be complicated by differences in approach and definitions in regard to coping. For example, some authors differentiate problem-focused and emotion-focused coping strategies [19], while others distinguish between approach- versus avoidance-oriented coping [20], adaptive versus maladaptive coping [21], and active versus passive coping [22,23]. 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 [24].

People suffering TMD present greater use of maladaptive coping responses and while employing fewer adaptive ones [25,26]. Specifically, TMD patients use more escape-avoidance strategies [26], less problem solving strategies [25], minor use of positive reinterpretation and humor as coping strategies, and show lower interest in seeking instrumental social support [25]. 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 [27]. Furthermore, avoidance and passive coping strategies might also affect oral health-related quality of life in patients with myalgia [28]. 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 [29,30].

Indeed, different perspectives and assessments in regard to coping have led to a variety of results and interpretations. 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 taking into account the different TMD types according to the DC/TMD criteria, and particularly myalgia patients [31]. 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 coping in TMD, taking into account new TMD types.

This study aims to investigate the levels of anxiety, personality factors, and coping behavior (see table 1 for scales) in a group of university students presenting myalgia, according to de DC-TMD, in comparison to a control group free of symptoms. It is hypothesized that myalgia group and the control group will differ significantly in terms of their coping strategy pattern, anxiety and neuroticism.

Table 1: Coping Response Inventory (CRI) scales [33] according to coping dimensions. Examples are given base on CRI specific questions.

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

Methods

A total of 102 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 with active orthodontic or psychopharmacological treatment were excluded from 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 either the myalgia group nor the control group. That is to say, control group was composed of 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.

In order to evaluate participants' oral history, they were administered a questionnaire regarding demographic data (i.e. gender, age, ethnicity, family income), as well as the TMD Pain Screener and the Symptom Questionnaire by the Diagnostic Criteria (DC/TMD) Axis I evaluation [31].

After completing the questionnaires related to participants' oral history, two dentists specialized in TMD performed oral examinations of TMD signs and symptoms using the DC/TMD Examination protocol. 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-esthetic agreement, resulting in a good degree of agreement, expressed by a Kappa index of 0.76. The examination included TMJ palpation, masticatory muscles palpation and assessment of opening movement patterns and joint sounds like clicks or crepitation.

Once signs and symptoms were assessed, two groups of participants were formed. 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"[31]. The control group (N=25, 7 males) consisted of students who did not show any signs nor symptoms of any type of TMD.

Following the oral examinations, participants were called back two weeks later to complete the psychological questionnaires. Stressful periods like examination dates were avoided during data collection.

The evaluation of psychological factors included anxiety, stress coping and personality measurements. Anxiety was measured with the State-trait anxiety inventory (STAI), which includes 20 items for assessing trait anxiety (STAI-T) and 20 for assessing state anxiety (STAI-S) [32]. 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. These 8 scales are classified according to two dimensions identified in the literature [33]: cognitive and behavioral approach coping on the one hand, and cognitive and behavioral 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. [34]. All selected tests are validated for a Spanish sample (Spain), are commonly used in research [35] and have high levels of reliability (Cronbach alphas between 0,59 and 0,93) and validity (correlations generally above 0,70), [32, 33, 34]. A blind correction of the questionnaires was done by two psychologists specialized in health psychology and psychological assessment, who did not know to which group each participant belonged, in order to eliminate biases.

Statistical analyses were calculated using SPSS 21 Statistics Software (IBM). First at all, data were standardized by calculating the t-scores ($c = 50$, $sd = 10$) of each scale within each questionnaire. Second, a one-way multiple variable analyses of variance (MANOVA) was performed, where the intersubject factor was the group (miagia vs controls) and the dependent variables were every scale of each test. This type of analyses was chosen, because one of its benefits is to avoid inflating risk of Type 1 error than might occur by conducting multiple t-tests. Furthermore, effect size (partial eta squared: η^2p) and power (π) were calculated for each variable included in the MANOVA.

Results

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 ($F_{(1,47)} = 4.46$ $p = .04$, $\eta^2p = .087$, $\pi = .544$) (see figure 2), while for anxiety state neither significant effects nor trends 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 ($F_{(1,47)} = 6.39$ $p = .015$, $\eta^2p = .120$, $\pi = .698$) No trends or significances were observed in the other variables of this questionnaire (see figure 3)

Lastly, with respect to coping measurements, the findings showed that the myalgia group presented significantly higher levels of Acceptance and Resignation ($F_{(1,47)} = 4.21$ $p = .046$, $\eta^2p = .082$, $\pi = .521$) and Seeking Alternative Reward ($F_{(1,47)} = 5.69$ $p = .021$, $\eta^2p = .108$, $\pi = .647$) in comparison to the control group. Regarding the type of strategy, statistically significant differences were found for avoidance strategies ($F_{(1,47)} = 8.58$ $p = .005$, $\eta^2p = .154$, $\pi = .819$), and tendencies were detected for cognitive ($F_{(1,47)} = 3.76$ $p = .058$, $\eta^2p = .074$, $\pi = .477$) and behavioral strategies ($F_{(1,47)} = 3.97$ $p = .052$, $\eta^2p = .078$, $\pi = .497$). Overall, the myalgia group presented larger use of these types of strategies than the control group. No trends or significances were observed in the other variables of this questionnaire (see figure 4)

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 [32,33,34].

	Group	Mean	Standard deviation	Percentile score	F _(1,47)	Sig.	Effect size (η ² p)	Power (π)																																																																																																																																						
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		Myalgia	53.21	9.01
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CRI - Cognitive Avoidance	Control	49.68	10.14	50				
	Myalgia	56.67	12.39	70	4.21	.04	.082	.521
CRI- Acceptance or Resignation	Control	50.12	9.8	50				
	Myalgia	52.92	14.89	60	5.69	.02	.108	.647
CRI - Seeking Alternative Reward	Control	44.64	8.71	30				
	Myalgia	50.75	8.54	50	1.54	.22	.032	.230
CRI - Emotional Discharge	Control	47.92	7.36	40				
Cognitive coping	Myalgia	52.35	6.72	60	3.76	.058	.074	.477
	Control	49.05	5.11	45				
Behavioral coping	Myalgia	51.51	7.13	55	3.97	.052	.078	.497
	Control	48.21	4.11	45				
Approach coping	Myalgia	50.48	6.86	50	.55	.46	.012	.113
	Control	49.17	5.41	45				
Avoidance coping	Myalgia	53.38	6.98	60	8.6	.005	.154	.819
	Control	48.09	5.61	45				

Discussion

Perhaps the most straightforward finding from the present study is that out of the 102 individuals initially considered, 24 of them suffered from myalgia, although the majority of these participants did not consider it severe enough to request professional help. Only 24 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 [7,36,37,38,39]. Furthermore, participants average score of the psychological questionnaires were similar to others Spanish university students (Spain), since percentiles were within 40 and 60 (See table 2), except for anxiety trait and logical analyses (30 and 35, respectively), according to norms provided by questionnaire manuals [32,33,34]. 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 taking in 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, the myalgia group showed higher levels of trait anxiety than the control group [2-4,8,9,13,25,40] However, while the OPPERA prospective cohort study detected significantly larger levels of trait and state anxiety for TMD patients [14], in the present study state anxiety differences were not of significance. 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.

Though neuroticism seems to be strongly associated with TMD [3,13], the OPPERA cohort study found that it was a weak predictor of TMD. Nonetheless, the later study did not differentiate between articular and muscular TMD pathologies. Ferrando et al. [25] showed that myofascial patients present higher levels of depression and neuroticism, whereas conscientiousness and self-discipline were higher in the articular group. Similarly, present findings show that myalgic participants have larger levels of neuroticism than controls. Altogether, these results suggest that neuroticism might be an important personality factor contributing to TMD, at least for myalgia.

Coping styles were thoroughly investigated by means of the CRI inventory in the present study. Acceptance and Resignation as well as Seeking Alternative Reward were more prevalent in myalgia group than in the control group. In addition, the myalgia group used significantly more often avoidance coping strategies. Therefore, it could be said that myalgia 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, [41]. 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 have been previously described, which were interpreted as maladaptive [24,26]. 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 [28]. In contrast, some studies have observed higher levels of active coping in masticatory muscle pain patients in comparison with articular pain patients [17,29,30], 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 TMD coping studies in the literature make similarities hard to establish. For example, seeking an alternative reward, which is classified as an avoidance strategy, according to the coping model in the present study [33] is sometimes conceptualized as an adaptive strategy instead of maladaptive, especially in situations where things cannot be changed [27]. Nonetheless, the majority of participants, when asked in the CRI, reported stress in situations where output clearly depended on their behavior, such as university exams.

The way people face problems or stressful situations and the way in which they interpret them, might be an important key to explain why some individuals might have more chances to develop a myalgia. The data supports this hypothesis, as it indicated larger levels of maladaptive coping styles, but not of state anxiety, for myalgia patients in comparison to the control group. The well-known OPPERA study investigated pain coping, but not general coping strategies. However, they established that perceived stress increased the risk of first-onset TMD [14,17,42]. Perceived stress has been negatively related to emotional intelligence and to adaptive coping strategies. Specifically, maladaptive coping strategies might increase perceived stress, a strong predictor of TMD [43,44].

In a follow up of the OPPERA study, it was recently reported that psychological and social variables changed in parallel with TMD status [16]. Therefore, interventions to prevent maladaptive coping styles and encourage adaptive coping tailored to the needs of myalgia patients might improve general treatment and recovery [45]

The present study clearly points out the importance of coping styles in myalgia, although several limitations should be addressed for 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 a similar environment, educational level, 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 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. Since avoidance behavior has often been considered maladaptive and is related to the increase of perceived stress, psychological interventions to reduce stress levels, prevent maladaptive coping styles and increase awareness, might improve temporomandibular health and prevent severe and/or chronic myalgia. However, further research is required in myalgia which includes other psychological factors, such as emotional intelligence, in larger and more heterogeneous samples.

List Of Abbreviations

TMD: Temporomandibular disorders

TMJ: Temporomandibular joint

DC/TMD: Diagnostic criteria of temporomandibular disorders

AAOP: American Academy of Orofacial Pain

OPPERA study: Orofacial pain prospective evaluation and risk assessment study

STAI: State-Trait Anxiety Inventory

NEO-FFI: Neo Five-Factor Inventory

CRI: Coping Responses Inventory

MANOVA: Multivariate analysis of variance

Declarations

Ethics approval and consent to participate

Participants were clinically evaluated 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).

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request

Competing interests

All authors declare there are non-financial competing interests (political, personal, religious, ideological, academic, intellectual, commercial or any other) in relation to this manuscript.

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Authors' contributions

XSG, ACV and LJO conceived and designed the study, performed the questionnaires correction, statistical analysis, participated in the interpretation of the data, and the manuscript drafting.

FPG and LSL participated in the data collection

ADG, TSS and IAG, conceived and designed the study and collaborated in the interpretation of the data

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Figures

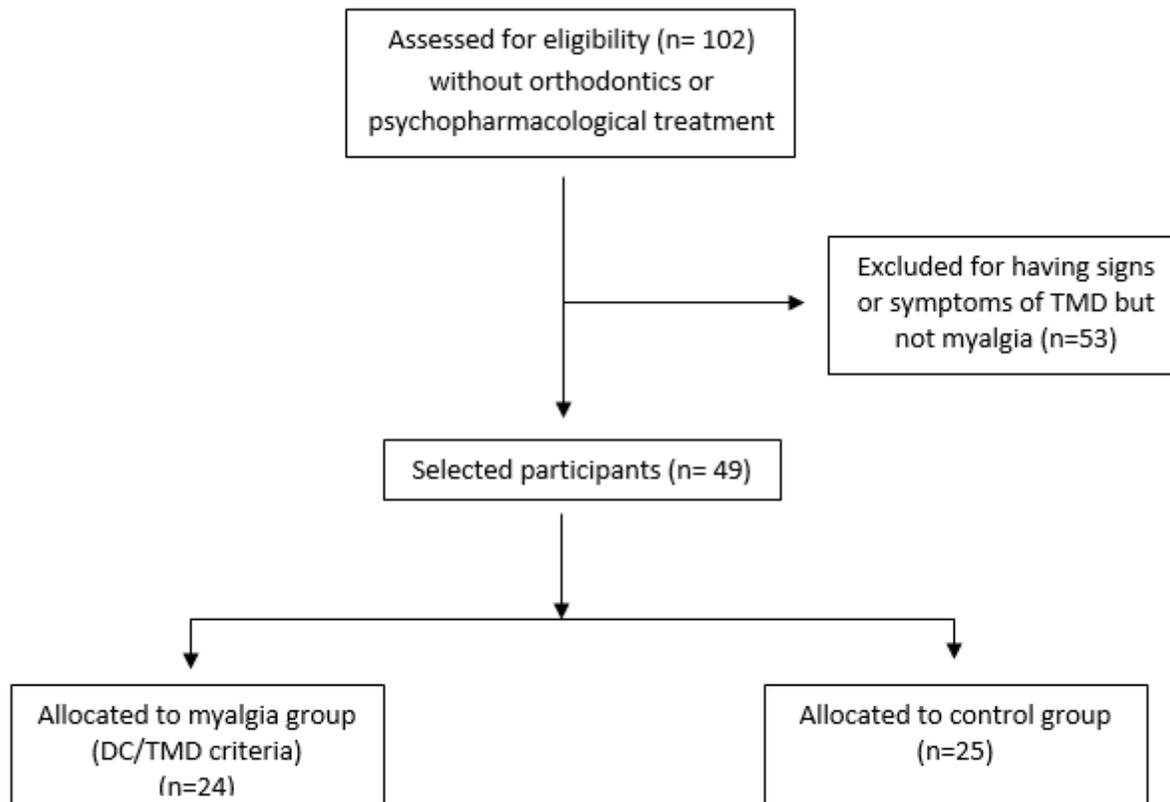


Figure 1

Consort-scheme of participant selection and eligibility criteria

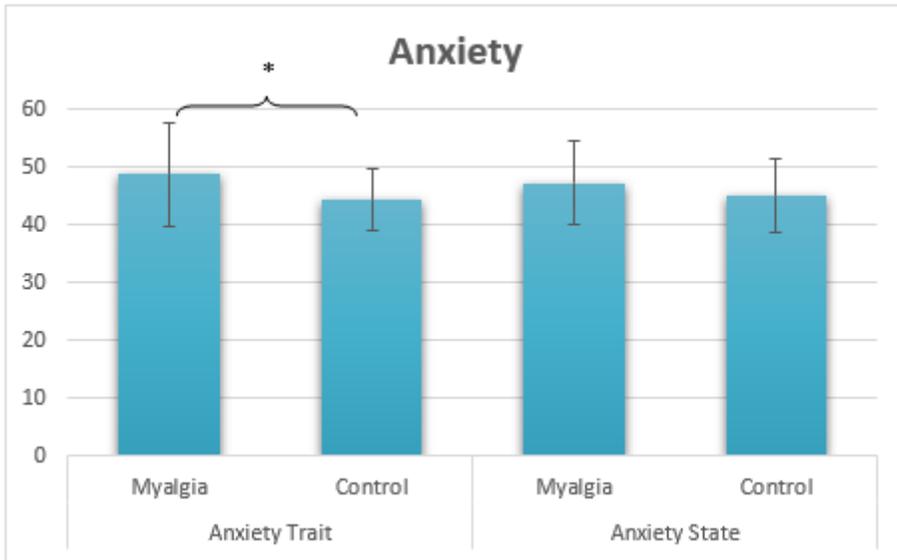


Figure 2

State-Trait Anxiety Inventory results. (Graphic shows t-scores of the test). *: p<.05

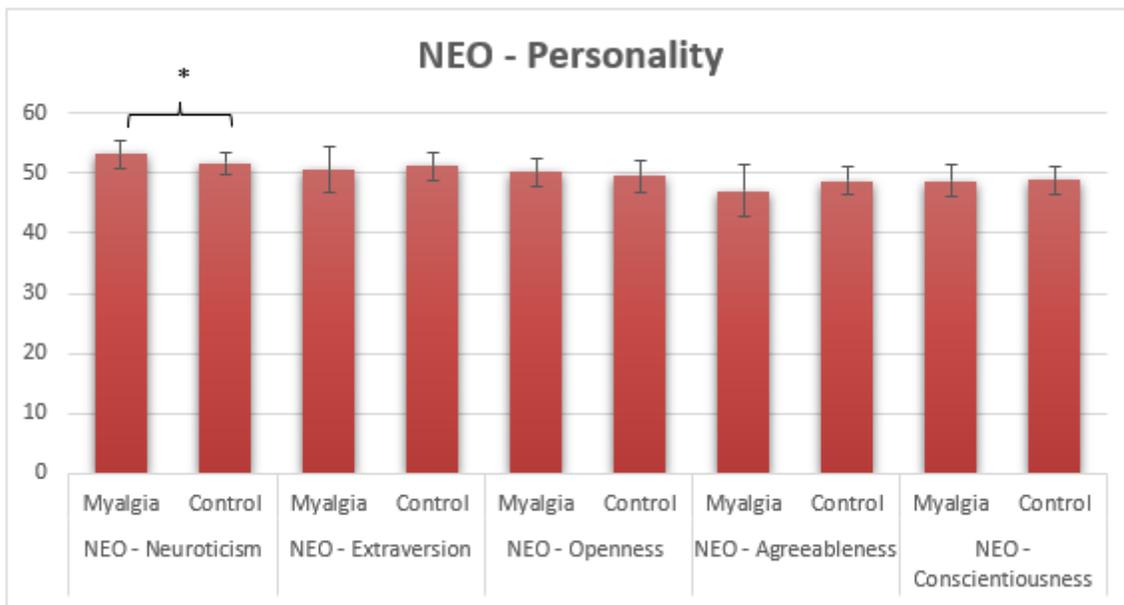


Figure 3

NEO five factor inventory results. (Graphic shows t-scores of the test). *: p<.05

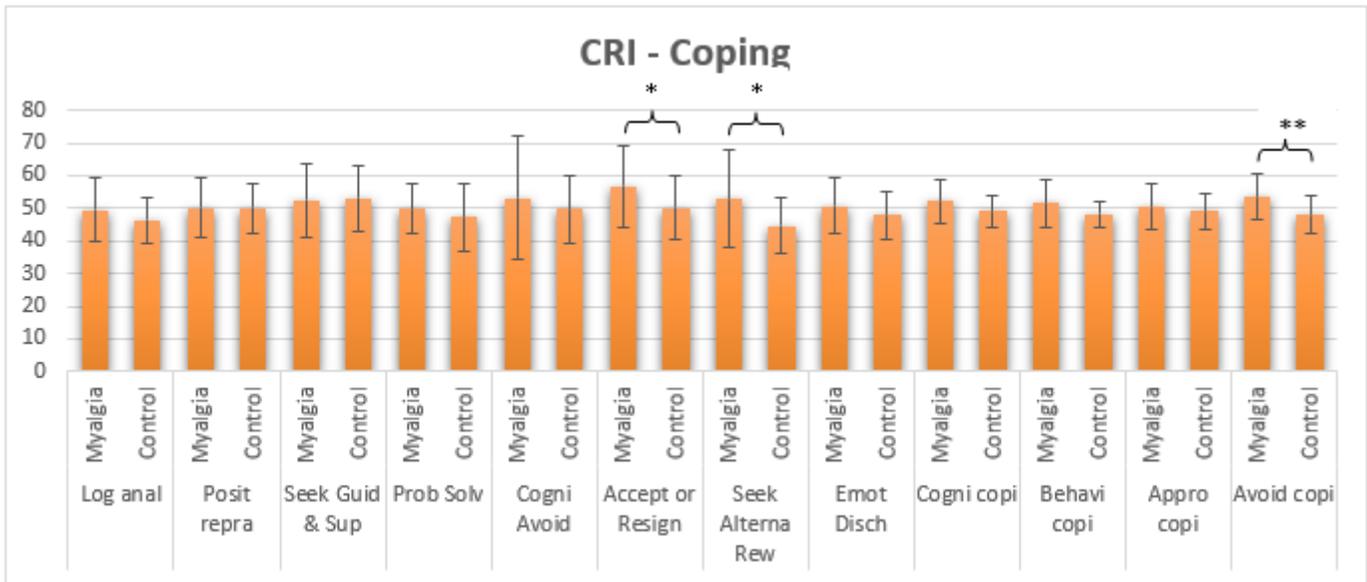


Figure 4

Coping responses inventory results. (Graphic shows t-scores of the test). *: $p < .05$; **: $p < .01$