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Comparison Between Chronic Migraine and Temporomandibular Disorders in Pain-Related Disability and Fear-Avoidance Behaviors

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Abstract

Objective. To compare patients with chronic migraine
(CM) and chronic temporomandibular disorders
(TMD) on disability, pain, and fear avoidance factors
and to associate these variables within groups.

Design. Descriptive, cross-sectional study.

Settings. A neurology department and a temporo-
mandibular disorders consult in a tertiary care center.

Subjects. A total of 50 patients with CM and 51 pa-
tients with chronic TMD, classified by international
criteria classifications.

Methods. The variables evaluated included pain in-
tensity (visual analog scale [VAS]), neck disability
(NDI), craniofacial pain and disability (CF-PDI),
headache impact (HIT-6), pain catastrophizing
(PCS), and kinesiophobia (TSK-11).

Results. Statistically significant differences were
found between the CM group and the chronic TMD
group in CF-PDI ($P < 0.001$), PCS ($P = 0.03$), and HIT-
6 ($P < 0.001$); however, there were no differences be-
tween the CM group and the VAS, NDI, and TSK-11
groups ($P > 0.05$). For the chronic TMD group, the
combination of NDI and TSK-11 was a significant
covariate model of CF-PDI (adjusted $R^2 = 0.34$). In
the CM group, the regression model showed that
NDI was a significant predictive factor for HIT-6 (ad-
justed $R^2 = 0.19$).

Conclusions. Differences between the CM group
and the chronic TMD group were found in craniofacial
pain and disability, pain catastrophizing, and head-
ache impact, but they were similar for pain intensity,
neck disability, and kinesiophobia. Neck disability
and kinesiophobia were covariates of craniofacial
pain and disability (34% of variance) for chronic TMD.
In the CM group, neck disability was a predictive fac-
tor for headache impact (19.3% of variance).

Key Words. Temporomandibular Disorders;
Chronic Migraine; Disability; Pain Catastrophizing;
Kinesiophobia; Cross-Sectional

Introduction

In recent decades, an increasing number of studies
have investigated the relevance of overlapping signs
and symptoms between chronic headaches and chronic
temporomandibular disorders (TMDs). These chronic

disorders include a minimum symptom duration of three months.

The third edition of the International Classification of Headache Disorders (ICHD-3) includes six major categories of headache [1], and chronic migraine (CM) has been included as one of them. The prevalence of CM has been estimated between 1.1% and 2% [2,3], and it is more likely to be found in women [3]. Regarding the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) Axis I, myofascial pain disorder (group I) and arthralgia disease (group IIIa) can be present at the same time [4], representing a mixed TMD. Myofascial pain disorders and arthralgia disease are included within the four TMD diagnoses that occur most frequently [4]. Moreover, in ICHD-3, one type of secondary headache has been attributed to TMD [1].

CM has been reported as highly disabling among those with the condition. Bigal et al. concluded that CM was disabling in the population regarding missed days of work, household chores, nonwork activity, and days with substantially reduced productivity over a three-month period [5].

Several studies have found symptoms shared between both CM and chronic TMD entities. TMD symptoms are common in CM [6], and patients with CM were significantly more likely to have tenderness in the masticatory muscles relative to controls without headache [7]. Previous studies have shown the relevant role of certain psychological factors in patient adaptation [8,9]. One of the most relevant variables predicting variability in pain disability among chronic pain patients included those for whom craniofacial pain [10] is catastrophizing [11]. This cognitive variable, defined as an excessive response by an individual to their pain, plays a central role in pain disability and in duration of pain. According to the fear avoidance model of chronic pain, pain catastrophizing has been suggested to predispose individuals toward the development of fear of movement, which can lead to increased disability [12].

Recent research has shown that the level of pain catastrophizing is higher in both patients with TMD and those with CM, compared with healthy matched controls, and fear of movement was different in TMD sufferers than in healthy people [13]. In addition, previous studies have indicated that patients with chronic headaches have high levels of kinesiophobia, which increases their disability [14]. The kinesiophobia has been defined as fear of movement and re-injury. There is a scarcity of evidence, however, about the relationship between catastrophizing, kinesiophobia, and disability among patients with chronic TMD and CM and the differences in these variables among these groups of patients.

Although some studies have examined CM and chronic TMD, it seems that neither the source of the disorders nor the best way to treat them is understood, as yet.

The authors of the present study support the idea that both disorders could be comorbid and might be associated in their pathophysiology.

The primary objective of this study was to describe similarities and differences between patients with CM and patients with chronic TMD in terms of disability and psychological factors such as catastrophizing and kinesiophobia. The secondary objective was to associate and find predictors of disability, pain intensity, impact of headaches, and fear avoidance variables within each group.

Methods

According to International Recommendations for Observational Studies, items on the Strengthening the Reporting of Observational Studies in Epidemiology checklist were followed for this study [15].

A cross-sectional study was conducted at La Paz University Hospital in Madrid (Spain). Patients with CM or chronic TMD participated in the study. Between January 2013 and August 2015, consecutive outpatients with CM and chronic TMD who were age 18 years or older were recruited from the Neurology Department (Headache Unit) and the Temporomandibular Joint Consult of this public hospital. This study was designed to compare and associate various factors among patients with CM and chronic TMD.

The measures were collected by experienced (more than 10 years) physiotherapists, specialists in pain management, and members of the Spanish Pain Society (Chapter of The International Association for Study of Pain).

Standard Protocol Approval and Patient Consent

Following the Helsinki Declaration, our study was approved by the Ethics Committee for Clinical Research of a public reference hospital in Madrid (Spain), and written informed consent was obtained from all the participants (PI-1241).

Patients with CM

Patients fulfilling the following criteria were included: age 18 years or older and chronic migraine (ICHD–III, code 1.3) [1]. Recently revised, the new definition requires 15 or more headache days per month over the past three months, with at least eight headache days per month that meet criteria for migraine without aura [3]. Exclusion criteria consisted of having the following: concomitant painful disorders such as TMD or tension-type headache; other types of diagnosed neurologic disorders; neck or temporomandibular osteoarthritis; rheumatic and systematic diseases; history of trauma or surgery in the head, face, and/or neck; pregnancy; and the use of an acute abortive antimigraine treatment in the previous three days.

Patients with Chronic TMD

For this group, inclusion criteria were age 18 years or older, combined chronic orofacial pain consisting of myofascial pain disorder (group I) and arthralgia disease (group IIIa diagnosis) according to RDC/TMD [16]. Exclusion criteria were the following: primary headache diagnosis (with the exception of infrequent episodic tension-type headache); neurological and psychiatric disorders; neck or temporomandibular osteoarthritis; rheumatic and systematic diseases; history of trauma or surgery in the head, face, and/or neck; pregnancy; and the use of acute analgesic treatment in the previous 48 hours.

Survey Description

Five self-administered questionnaires were given to the participants, and three major variables were measured (pain intensity, disabilities, and psychological factors).

Pain Intensity

To collect this variable, a visual analog scale (VAS) was used, which is a well-established and validated self-report to measure the intensity of pain. It consists of a 100 mm line in which 0 indicates no pain and 100 indicates the worst pain imaginable by the patient [17,18]. The patients should indicate where their pain is generally located within the measure described above.

Disability

The Spanish version of the Neck Disability Index (NDI) [19] measures perceived neck disability. This questionnaire consists of 10 items, with six possible answers that represent six levels of functional capacity, ranging from 0 (no disability) to 5 (complete disability) points. This version of the NDI is reliable, valid, and sensitive to change [19].

A novel self-administered questionnaire (Craniofacial Pain and Disability Inventory [CF-PDI]) [20] designed to measure pain, disability, and functional status of the mandibular and craniofacial regions was used. The CF-PDI has a good structure, internal consistency, reproducibility, and construct validity and provides an objective tool for assessing pain and disability in patients with craniofacial pain [20].

The severity and impact of headache on the patient's life was measured using the Spanish version of the Headache Impact Test (HIT-6) [21]. The HIT-6 is a six-item questionnaire that has demonstrated acceptable psychometric properties [21].

Psychological

The Spanish version [22] of the pain catastrophizing scale (PCS) was used to assess pain-related catastrophic thoughts. The PCS reflects 13 thoughts and feelings that can arise when people have pain (e.g., "I keep thinking about how much it hurts"; "There is nothing I can do to reduce the intensity of the pain"). The PCS is divided into three subscales: rumination (four items), magnification (three items), and helplessness (six items). The answers are given on a five-point scale, in which the respondents rate to what extent they have these thoughts and feelings when experiencing pain (0 = not at all, 4 = all the time). The PCS has been shown to have good psychometric properties [22].

The Tampa Scale of Kinesiophobia (TSK) has been used to assess fear of movement and re-injury and has adequate psychometric properties on its 11-item scale (TSK-11). It was originally described by Woby et al. and is scored identically to the original version, except that there are no reverse-coded items [23]. The Spanish version of TSK-11 shows good reliability (internal consistency and stability) and validity (convergent and predictive), with the advantage of brevity [24]. The TSK-11 has a two-factor structure: activity avoidance and harm. The total score ranges from 11 to 44 points, and higher scores signify greater fear of movement and fear of re-injury due to movement.

Sample Size

The G*Power Program 3.1.7 from the University of Düsseldorf was used to calculate the sample size of this study. The Student's t test was conducted to calculate the difference between two independent means (two groups). We set an α-error probability of 0.05 and a power (1-β error probability) of 80% to detect changes in a bilateral comparison of the null hypothesis of the mean and an effect size of 0.4, which was obtained from our previous pilot study with 10 patients per group, considering craniofacial pain and disability as the main variable where the means were 21.21 (SD = 11.6) for CM and 25.35 (SD = 8.8) for chronic TMD. The total sample size was 98 patients.

Analysis Data

The sociodemographic and clinical variables of the patients were analyzed. The data were summarized using frequency counts, descriptive statistics, summary tables, and figures.

The data analysis was performed using the Statistics Package for Social Science (SPSS 20.00, IBM Inc., USA). The categorical variables are shown as frequency and percentage. The quantitative results of the study are represented by descriptive statistics (confidence interval [CI], mean, and standard deviation [SD]). For all variables, the z-score was assumed to follow a normal distribution based on the central limit theorem because all the groups had more than 30 subjects [25,26]. The Student's t test was used for the group comparisons. Cohen's d effect sizes were calculated for multiple comparisons of the outcome variables. According to Cohen's method, the magnitude of the effect was

classified as small (0.20–0.49), medium (0.50–0.79), or large (0.8). A multivariate analysis of covariance (MANCOVA) was conducted to determine whether time of chronicity was a confounder variable.

The relationship between pain-related and psychological measures was examined using Pearson correlation coefficients. A Pearson correlation coefficient greater than 0.60 indicated a strong correlation, a coefficient between 0.30 and 0.60 indicated a moderate correlation, and a coefficient below 0.30 indicated a low or very low correlation [27].

A multiple linear regression analysis was performed to estimate the strength of the associations between the results of craniofacial disability. Psychological and pain-related disability variables were used as predictors. Variance inflation factors (VIFs) were calculated to determine whether there were any multicollinearity issues in any of the models. The strength of the association was examined using regression coefficients (β), P values, and adjusted R^2. Standardized beta coefficients were reported for each predictor variable included in the final reduced models to allow for a direct comparison between the predictor variables in the regression model and the criterion variable being studied. For data analysis, we used a confidence interval of 95%, considering all those values that had a P value of less than 0.05 to be statistically significant.

Efforts were made to avoid bias. All the participants maintained their preventive treatment to avoid participation bias. Moreover, the assessor therapist was blinded to the patient's condition to eliminate suspected diagnostic bias.

Results

Of 101 total patients (85.1% female, mean age = 47.3 ± 12.4 years), 50 had been diagnosed with CM (four men and 46 women, mean age = 48.58 ± 13.19 years) and 51 with chronic TMD (11 men and 40 women, mean age = 46.20 ± 11.74 years). No statistically significant differences between groups were seen in relation to demographic variables except time of chronicity ($t = 8.22$, $P < 0.00$), which was higher in the CM group. The MANCOVA showed that time of chronicity was not a statistically significant confounder for pain intensity (F = 2.11, $P = .15$, $\eta^2_p = 0.03$), neck disability (F = 0.92, $P = 0.34$, $\eta^2_p = 0.01$), craniofacial pain and disability (F = 0.31, $P = 0.58$, $\eta^2_p = 0.004$), kinesiophobia (F = 0.28, $P = 0.6$, $\eta^2_p = 0.04$) or headache impact (F = 0.72, $P = 0.4$, $\eta^2_p = 0.01$). The demographic characteristics are summarized in Table 1.

Comparisons

The results of the Student's t test revealed statistically significant differences between the CM group and the chronic TMD group in CF-PDI ($t = 3.93$, $P < 0.001$) and PCS ($t = 2.12$, $P = 0.03$), including rumination ($t = 3.52$,

$P < 0.001$) and helplessness ($t = 2.81$, $P = 0.007$), and HIT6 ($t = 5.57$, $P < .001$). However, there were no differences between groups for VAS, NDI, magnification, and TSK-11 (all $P > 0.05$). Table 2 shows the values and effect sizes (Cohen's d) of pain-related variables, disability, and psychological characteristics of the sample such as mean ± SD of each group and mean differences (95% CIs) between groups.

Correlations

The authors examined the association using Pearson correlation coefficients among VAS, NDI, CF-PDI, PCS, TSK-11, and HIT-6 for each patient group (Table 3). The largest association observed in the chronic TMD group was between NDI and PCS ($r = 0.61$, $P < 0.001$), whereas in the CM group the largest associations were between NDI and CF-PDI ($r = 0.75$, $P < 0.001$) and between NDI and VAS ($r = 0.59$, $P < 0.001$), summarized in Table 3.

Multiple Linear Regression

The regression models for criterion variables (CF-PDI and HIT-6) are presented in Table 4. The regression model for the chronic TMD group showed that a combination of NDI and TSK-11 was a significant covariate of CF-PDI (adjusted $R^2 = 0.34$). For this same group, the significant covariate of HIT-6 was also CF-PDI (adjusted $R^2 = 0.06$). In the CM group, the regression model showed that NDI was a significant predictive factor for HIT-6 (adjusted $R^2 = 0.19$).

Discussion

The results of this study demonstrate that two craniofacial and chronic painful conditions, CM and chronic TMD, have similar levels of neck disability, pain intensity, magnification of pain, and kinesiophobia. On the other hand, our results showed differences between levels of craniofacial pain and disability, pain catastrophizing, or impact of headache between the CM and chronic TMD groups. Other authors have also investigated the relationship between these two ailments, concluding that migraine is the most prevalent primary headache in individuals with TMD [28]. Although several studies have researched disability, pain, quality of life, and fear avoidance models, this is the first study to compare patients with chronic TMD and CM.

Similarities and Differences

Both patients with CM and those with TMD presented moderate to severe levels of pain (60.44 mm and 61.16 mm, respectively). Our results are consistent with Stewart et al., who found that 74% of their sample had a range of 50 to 80 mm in pain intensity [29]. Although recent studies appear to have shown that pain frequency could be more disabling than pain intensity, the results are not entirely clear [30]. The present study shows that CM and chronic TMD present high levels of

Table 1 Summary of demographic variables

	Mean ± SD or No. (%)		
	CM (N = 50)	Chronic TMD (N = 51)	*P* Value of Independent Samples X^2 Test
Age, y	48.5 ± 13.2	46.2 ± 11.7	0.39
Sex			0.06
Female	46 (92)	40 (78.4)	—
Male	4 (8)	11 (21.6)	—
Height, cm	1.61 ± 0.07	1.63 ± 0.08	0.16
Weight, kg	64.13 ± 11.06	65.8 ± 9.8	0.54
Chronicity, mo	345.1 ± 196	106.1 ± 62.2	0.00*

CM = Chronic MIgraine; TMD = Temporomandibular Disorders.
*$P < 0.05$.

Table 2 T-Student comparisons between groups and effect size of difference

	CM (N = 50)	Chronic TMD (N = 51)	Mean Differences	95% CI	Cohen's *d*
VAS	60.44 ± 17.86	61.16 ± 10.46	−0.72	−5.08 to 6.52	−0.05
NDI	21.00 ± 8.18	19.92 ± 3.77	1.08	−3.63 to 1.47	0.17
CF-PDI	19.58 ± 12.32	27.84 ± 8.00	−8.26	4.14 to 12.38**	−0.80
PCS	30.43 ± 11.54	26.20 ± 7.30	4.23	−8.14 to −0.32*	0.44
Rumination	11.60 ± 3.60	9.22 ± 2.53	2.38	−3.67 to −1.08**	0.77
Magnification	5.58 ± 3.10	6.39 ± 2.14	−0.81	−0.29 to 1.92	−0.3
Helplessness	14.00 ± 6.07	10.84 ± 4.10	3.16	−5.32 to −1.01**	0.61
TSK-11	26.98 ± 6.99	26.76 ± 6.47	0.22	−2.97 to 2.52	0.03
HIT-6	63.23 ± 5.89	56.43 ± 5.62	6.80	−9.23 to −4.37**	1.18

CF-PDI = Craniofacial Pain and Disability Inventory; CM = Chronic Migraine; HIT-6 = Headache Impact Test; NDI = Neck Disability Index; PCS = Pain Catastrophizing Scale; TMD = Temporomandibular Disorders; TSK-11 = Tampa Scale of Kinesiophobia; VAS = Visual Analog Scale.
*$P < 0.05$.
**$P < 0.013$.

pain intensity, which could influence quality of life. It must be considered that primary headaches can present as chronic orofacial pain, such as in the case of facial migraine, where the pain is localized in the second and third division of the trigeminal nerve or tension-type headache [31]. That is why, to avoid confusion with possible comorbidities, it has been decided that the patients did not present a diagnosis of tension-type headache. Previous studies have presented the relationship between chronic TMD and CM [7,28,32], and this work intends to further deepen these disorders independently of other frequent comorbidities.

Regarding neck disability, our results are in accordance with previous studies showing neck disability in patients with CM at even higher levels than those of patients with tension-type headache. Florencio et al. reported a high prevalence of neck disability in patients with migraine and determined that individuals with CM were at a significantly increased risk of mild, moderate, or severe cervical disability relative to those with episodic migraine [33]. Migraineurs are more likely to have cervical muscle tenderness, myofascial referred pain from neck muscles, or decreased pressure pain threshold above cervical muscles [34–37]. In addition, the overlap between neck pain disability and migraine could be supported by a hypothetical role of the trigeminocervical complex in migraineurs [38]. Neck disability has also been studied in TMD, and patients with TMD have been shown to have high levels of cervical disability [39,40], which coincides with the results of the present study. Despite current evidence regarding neck disability and CM or TMD independently, to our knowledge, no previous studies have compared the differences between CM and chronic TMD. Perhaps intercommunication throughout second-order neurons in the trigeminocervical nucleus with C1-C3 neural roots could be responsible for neck symptoms and disability in these pathological entities.

Kinesiophobia has been recognized as an important component of chronic pain [41]. The TSK is a common

Table 3 Pearson correlation coefficient for all outcomes in each group

Group		VAS	NDI	CF-PDI	PCS	TSK-11	HIT-6
Chronic TMD	*VAS*	1	0.079	0.187	0.222	0.275	0.128
CM		1	0.594**	0.440**	0.113	0.129	0.335*
Chronic TMD	*NDI*		1	0.554**	0.606**	0.475**	0.141
CM			1	0.746**	0.284	0.355*	0.484**
Chronic TMD	*CF-PDI*			1	0.426**	0.482**	0.286*
CM				1	0.271	0.387*	0.184
Chronic TMD	*PCS*				1	0.543**	0.291*
CM					1	0.539**	0.365*
Chronic TMD	*TSK-11*					1	0.200
CM						1	0.276

CF-PDI = Craniofacial Pain and Disability Inventory; CM = Chronic Migraine; HIT-6 = Headache Impact Test; NDI = Neck Disability Index; PCS = Pain Catastrophizing Scale; TMD = Temporomandibular Disorders; TSK-11 = Tampa Scale of Kinesiophobia; VAS = Visual Analog Scale.
*$P < 0.05$.
**$P < 0.01$.

measurement tool used for these conditions, and TSK scores are positively correlated with catastrophizing [42], depression, and anxiety [43]. Clinical studies have suggested the importance of an excessively negative orientation toward pain (pain catastrophizing) and kinesiophobia in the etiology of chronic pain and associated disability [44]. In a previous study, our team found no differences between patients with CM and those with TMD in kinesiophobia levels [13]. The present study confirms this similarity. In addition to our study, only one previous study was found to be related to kinesiophobia and migraine. Martins et al. evaluated fear of movement (bending forward and head jolt) in migraine and concluded that aggravation of pain by movement and avoidance of movement were sensitive and specific manifestations of migraine that could contribute to its differentiation from patients with tension-type headache and patients with photophobia [14]. However, no information was found regarding the use of those constructs in a population of subjects with CM or chronic TMD.

Regarding pain catastrophizing, our results showed that people with CM showed more rumination and helplessness than patients with chronic TMD, but with similar levels of magnification. A recent study developed by Bond et al. showed a positive correlation between pain catastrophizing and frequency, chronicity, duration, intensity, and impact of headache attacks in women with migraine and obesity. They concluded that PCS scores were related to several migraine characteristics above and beyond the effects of obesity [45]. Pain catastrophizing has also been demonstrated to be an independent, robust predictor of impaired functioning and reduced quality of life in those with migraine [46]. Moreover, Goli et al. determined that both mood and catastrophizing were important factors in understanding migraine pain and recommended that future therapeutic interventions should focus on depression and catastrophism [47]. Nevertheless, pain catastrophizing and

depression as psychological factors related to pain intensity and disability have been studied in patients with TMD. Velly et al. reported similar results to those found in migraine: these factors contributed to the onset and progression of pain in TMD; thus, they proposed the need to consider both the evaluation and management of this condition [48]. Regarding our results, the higher levels of cervical disability and headache impact found in the CM group, in addition to to the chronicity and severity of migraine, might be related to higher scores in pain catastrophizing compared with those with TMD. A recent neuroanatomical study presented associations between pain catastrophizing and migraine disease variables with gray matter in areas implicated in processing the sensory, affective, and cognitive aspects of pain in patients, suggesting that these neuroanatomical changes could be a consequence of repeated, long-term nociceptive signaling, leading to increased pain sensitivity, mood disturbances, and maladaptive coping strategies to deal with unrelenting pain [49]. Concretely, the insula (involved in a number of neural processes) is a brain region that has received attention as "hub of activity" in patients with migraine and that could be a target as a model to study new potential clinical approaches to migraine [50].

Associations and Covariates

Regarding the associations among the variables, the primary result of this study showed a positive association between neck disability measured using the NDI and craniofacial pain and disability measured using the CF-PDI for both the CM and chronic TMD groups. The relationship between these constructs only takes into consideration the presence or absence of signs and symptoms, but does not consider the level of disability.

In relation to the psychological variables, when the predictor role of perceived neck disability is taken into

Table 4 Regression model for CF-PDI and HIT-6 in each group

Criterion Variable: CF-PDI

Group

Chronic TMD	Overall Model $R^2 = 0.368$, adjusted $R^2 = 0.340$, F = 13.381				
	Covariates	Regression Coefficient (B)	Standardized Coefficient (β)	P	VIF
	NDI	0.928	0.418	0.01*	1.29
	TSK-11	0.355	0.284	0.05*	1.29
	Excluded variables				
	VAS	—	0.076	0.539	1.08
	PCS	—	0.033	0.936	1.82
	HIT6	—	0.168	0.164	1.05

Criterion Variable: HIT-6

Group

Chronic TMD	Overall Model $R^2 = 0.085$, adjusted $R^2 = 0.066$, F = 4.381				
	Covariates	Regression Coefficient (B)	Standardized Coefficient (β)	P	VIF
	CF-PDI	0.203	0.097	0.042*	1.00
	Excluded variables				
	VAS	—	0.042	0.772	1.05
	TSK-11	—	0.077	0.634	1.30
	PCS	—	0.204	0.189	1.22
	NDI	—	0.027	0.873	1.44
CM	Overall Model $R^2 = 0.226$, adjusted $R^2 = 0.193$, F = 6.730				
	Covariates	Regression Coefficient (B)	Standardized Coefficient (β)	P	VIF
	NDI	0.362	0.140	0.016*	1.00
	Excluded variables				
	VAS	—	0.208	0.406	1.76
	TSK-11	—	0.125	0.545	1.19
	PCS	—	0.188	0.329	1.05
	CF-PDI	—	−0.354	0.216	2.36

CF-PDI = Craniofacial Pain and Disability Inventory; CM = Chronic Migraine; HIT-6 = Headache Impact Test; NDI = Neck Disability Index; PCS = Pain Catastrophizing Scale; TMD = Temporomandibular Disorders; TSK-11 = Tampa Scale of Kinesiophobia; VAS = Visual Analog Scale; VIF = Variance Inflation Factor.
*$P < 0.01$.
*$P < 0.05$.

account, neither catastrophizing nor fear of pain added a significant percentage of explained variance to functional affectation in the CM group (i.e., pain, disability, and functional status, measured by CF-PDI). This does not mean, however, that psychological variables are irrelevant to perceived disability. As can be verified in correlation analyses, kinesiophobia was related to greater

disability for both patients with CM and those with TMD; specifically, functional problems such as temporomandibular joint sounds or a stuck/locked feeling were more strongly associated with fear of movement than with pain [51]. Although patients with more kinesiophobia showed more catastrophizing in both groups, the data showed a direct relationship between catastrophic

thoughts and disability only in the TMD group. These results support the fear avoidance model for both groups, given that they are congruent with a mediational role of kinesiophobia in the catastrophizing-disability relationship [12]. The absence of a direct relationship between catastrophizing and disability in the CM group leads us to consider the possibility of moderator variables that modify this relationship in these patients. Further studies should focus on the existence or not of these moderator variables.

According to the regression model, the data show relevant new findings involving psychological aspects with physical signs and symptoms. Neck disability and fear of movement are covariates when craniofacial pain and disability is a criterion variable, explaining 34% of the variance in patients with chronic TMD. Other authors have noted this strong association between neck and jaw disability [52]; however, the present study includes the kinesiophobia construct as an important predictive factor in the model, and it must be taken into account. Regarding CM, neck disability has been observed to explain 19.3% of the variance when headache impact is a criterion variable. The amount of recent literature supporting the presence of neck disability in patients with migraine, particularly in CM, has been previously discussed. Some studies have suggested the upper cervical spine as an important treatment target [53].

Clinical Implications

We have found that cervical disability has a positive correlation with orofacial pain and disability and kinesiophobia for both groups, a positive correlation with pain catastrophizing in the TMD group, and a positive correlation with headache impact in the CM group. Therefore, it appears necessary to consider cervical disability as a good predictive factor for several variables in the evaluation and management of both patients with CM and those with chronic TMD. Moreover, fear of movement has been demonstrated to be a predictive factor for disability in patients with chronic TMD. It would be interesting to include a specific evaluation for fear of movement in these patients and propose new bio-behavioral approaches focusing on this factor. Evidence is growing for fear of movement to play an important role in the development of chronic pain; however, this construct has not yet received sufficient attention. In conclusion, psychosocial processes are essential in understanding the development of chronic pain, including the onset, exacerbation, and maintenance of these disorders [54].

Limitations

The present study has several limitations. A considerable limitation was the difference found in symptom duration between the CM and chronic TMD groups; however, the authors made a concerted effort to avoid this bias, including a MANCOVA analysis to control for this drawback. Outcomes related to depression and anxiety symptoms could have been interesting, as well as other physical variables such as somatosensory,

motor, or cervical/mandibular ranges of motion. Future studies should take into account these variables to strengthen this study. The long-term behavioral variables also need to be examined; this cross-sectional design has implicit limitations, and further prospective studies could be developed, allowing new and valuable information to be obtained for patients with CM and chronic TMD. Finally, there are migraine prevention therapies that may have longer-lasting preventive affects even if stopped three days or more from the time the subjects filled out their questionnaires. However, the authors only stopped the use of an abortive antimigraine treatment in the previous three days to avoid this possible bias.

Conclusions

In conclusion, differences between the CM group and the chronic TMD group were found in craniofacial pain and disability, pain catastrophizing, and headache impact; however, the results were similar for pain intensity, neck disability, and kinesiophobia. Neck disability and kinesiophobia were covariates of craniofacial pain and disability (34% of variance) for chronic TMD. In the CM group, neck disability was a predictive factor for headache impact (19.3% of variance).

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