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ORIGINAL RESEARCH

Correlations between anxiety, depression and pain in French adults with temporomandibular disorders: an exploratory observational study

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Abstract

Background: Chronic temporomandibular disorder (TMD) pain is frequently associated with psychological distress. This exploratory observational study aimed to assess pain intensity, pain-related disability, anxiety, and depression in French adults with painful chronic TMD in relation to sociodemographic factors. **Methods**: Seventy-five patients with chronic TMD were evaluated using the General Anxiety Disorder-7 (GAD-7), the Patient Health Questionnaire-9 (PHQ-9), and the Graded Chronic Pain Scale (GCPS). Sociodemographic variables were collected and analyzed as binary factors. Group comparisons were performed using Mann-Whitney U-tests. Associations between anxiety, depression, and pain were examined using Spearman's rank correlations with 95% confidence intervals. Statistical significance was set at $\alpha = 0.05$. **Results**: Severe anxiety was observed in 11% of participants, while 69% reported mild to severe depressive symptoms. High pain-related disability was reported by 22% of women and 25% of men. Strong correlations were identified between anxiety, depression, and pain, particularly among participants over 35 years old, unemployed/retired, or with family charge. **Conclusions**: Despite the limited sample size, findings suggest that psychological distress and its associations with pain may be influenced by sociodemographic factors in chronic TMD patients.

Keywords

Temporomandibular disorders; Psychosocial assessment; Chronic pain; Anxiety

1. Introduction

The term temporomandibular disorders (TMDs) encompasses a group of musculoskeletal and neuromuscular conditions that involve temporomandibular joints (TMJs), masticatory muscles, and all associated tissues. TMDs share certain specific signs and symptoms including pain around the jaw, ear, and temple; clicking, popping or grinding noises during jaw movements; and limitation or locking of jaw movements. TMDs are the second major cause of orofacial pain as well as the second main cause of pain and disability in the musculoskeletal system after chronic low-back pain. They affect between 5 and 12% of the general population [1]. The etiology of TMDs is complex, multifactorial, and remains partially unclear [2–4].

Since Dworkin and LeResche's work based on the biopsychosocial model of pain and the publication of the Research Diagnostic Criteria for Temporomandibular Disorders (RDC-TMD) in 1992 [5], the diagnosis of TMDs has been both physical (Axis I) and psychosocial (Axis II). The latest version of this classification, the DC-TMD [1] provides screening tools that offer clinicians a simple standardized way to assess pain intensity, pain-related disability, and psychological distress, including anxiety and depression, that are essential components of Axis II diagnosis. Among these tools, the Generalized Anxiety Disorder Scale (GAD-7) [6, 7] and the Patient Health Questionnaire (PHQ-9) [8, 9] are recommended to screen respectively for anxiety and depression [1]. For the assessment of chronic pain intensity and pain-related disability, the use of the Graded Chronic Pain Scale (GCPS) [10] questionnaire is necessary. In fact, the transition from acute to chronic pain is common in TMDs [11, 12] and negatively impacts the quality of life of patients.

Anxiety is a future-oriented state of worry and nervousness, marked by physical symptoms and often accompanied by compulsive behaviors. The transient experience of anxiety is a core component of the human condition, but when it becomes excessive, prolonged and more difficult to regulate, it can become a pathological condition [2, 3, 13, 14].

Depression is an affective disorder characterized by a pessimistic sense of inadequacy and a despondent lack of activity [15]. It is amongst the leading causes of disability worldwide, and its prevalence is increasing [16].

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Numerous studies have highlighted that patients suffering from TMD related chronic pain tend to experience higher levels of psychological distress [17–22]. Moreover, psychological dysfunction is associated with heightened severity and sustained persistence of TMD-related symptoms [18]. Anxiety and depression scores also increase as disability related to the disorder appears [19] and the highest levels of pain are associated with the most severe depression scores [17]. Psychosocial factors, thus, contribute to persistence and chronicization of TMD [12, 18, 23, 24] and are also at least as important for the treatment outcome as are initial pain and physical diagnosis [1, 25].

To a lesser extent, sociodemographic profiles, such as age, sex, marital status or employment, have also been explored in TMD patients, but studies show conflicting results [4, 26, 27]. The expression of TMDs may vary due to cultural differences. Psychosocial and sociodemographic factors have not been studied, to the best of our knowledge, in a French chronic TMD patient population.

The objective of the present study was, thus, to assess for the first time the pain intensity, pain-related disability, anxiety, and depression among a population of French adults with chronic TMD in relation to sociodemographic factors. This study seeks to fill a critical knowledge gap, namely the lack of data concerning French chronic TMD population evaluated using psychosocial and sociodemographic measures. Addressing this gap is particularly important, as these factors may play a substantial role in the clinical presentation and management of chronic TMD. Higher pain intensity is hypothesized to be positively associated with elevated levels of anxiety and depression, with these relationships varying according to sociodemographic characteristics. A better knowledge and understanding of these associations could provide critical help for clinicians in the screening and management of TMD patients.

2. Materials and methods

2.1 Population

This exploratory observational study was conducted in the Occlusodontics unit of the Dental Surgery department of Lille University Hospital (France). This outpatient unit is specialized in TMD treatment and primarily receives referred patients. The study followed standard ethical guidelines. Patient informed consent was obtained after appropriate information. It was approved by the CESREES (Ethics and Scientific Committee for Research, Studies and Evaluations in the field of health—Health Data Hub F20230324112741) and registered to the French data protection authority (2229520v0). The study was also conducted and reported in accordance with the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) guidelines [28]. The study included 75 patients who were suffering from TMD chronic pain between April 2023 and September 2024. The TMD for all the included patients was diagnosed according to the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) including both Axis I and Axis II diagnoses, however the study was focused on Axis II diagnostic assessment. The exclusion criteria were patients below the age of 18, patients unable to complete questionnaires, pain-free patients, patients with diagnoses other than TMD that could account for their orofacial pain, pain related to TMD experienced for less than three months, and previous trauma or surgery to the mandible.

No formal sample size calculation was done on the basis of statistical hypothesis regarding the descriptive and exploratory nature of the present study. With the 75 participants included in the study time, we have a precision of 0.15 to estimate a correlation coefficient (half of 95% confidence interval for an expected correlation coefficient of 0.5).

2.2 Data collection and assessment instruments

The sociodemographic data collected were gender (male/female), year of birth, professional situation (employed/unemployed or retired), and family charge (responsibility for at least one dependent child living under the same roof/no family charge).

Participants were screened for anxiety using the self-reported 7-item GAD-7. This questionnaire measures state anxiety symptoms over the past two weeks and is primarily a screening tool for generalized anxiety disorder. The questions concern the frequency of anxiety signs, worry, ability to relax, irritability, and related features [6]. Participants were asked to select one of the following four options: “not at all”, “several days”, “more than half the days”, and “nearly every day”. Each answer is assigned a score of 0, 1, 2, or 3, respectively. A total score of 5 or higher indicates mild anxiety, 10 or higher indicates moderate anxiety, and 15 or higher indicates severe anxiety [7].

Participants were screened for depression using the 9-item PHQ-9 [8]. The questionnaire includes questions regarding patient well-being. Participants had to choose one of the four options: “not at all”, “several days”, “more than half the days”, and “nearly every day”. Each answer was assigned a score of 0, 1, 2, or 3, respectively. The cutoff scores for mild, moderate, moderately severe, and severe depression are respectively 5, 10, 15, and 20, with a maximum possible score of 27 [9].

The assessment of pain was made using the GCPS questionnaire [10]. GCPS allows the scoring of both characteristic pain intensity (CPI) (from 0 to 100) and disability points (from 0 to 6). This questionnaire classifies patients into one of five pain and disability severity grades. Grade 0 stands for no pain, grade 1 for low disability and low intensity of pain, grade 2 for low disability but high intensity of pain, grade 3 for high disability and moderately limiting pain (3–4 disability points regardless of CPI), and grade 4 for high disability and severely limiting pain (5–6 disability points regardless of CPI).

Clinical data were collected using self-administrated questionnaires. The assessor was blinded to the participants’ answers to the questionnaires when collecting the sociodemographic data.

All participants were offered tailored clinical management within the unit according to their individual needs.

2.3 Statistical analysis

Anxiety (GAD-7), depression (PHQ-9), and CPI and disability points (GCPS) levels were described as ordinal variables using

number (%). Main socio-demographic characteristics (after considering age in two categories using a 35 median cut-off value) were also described as a number (%).

Anxiety, depression, and pain levels were compared with regards to socio-demographic data using the Mann-Whitney U-test. We assessed the pairwise correlation between anxiety, depression, and pain levels, overall and according to socio-demographic characteristics by calculating the Spearman's rank correlation coefficients (r); their 95% confidence intervals (CIs) were estimated using Fisher's z transformation. The size of r values (absolute value) were interpreted as moderate for 0.4–0.59, strong for 0.6–0.79, and as very strong when $>$0.8.

All statistical tests were conducted using the two-tailed α level of 0.05 without correction for multiple testing due to the exploratory nature of the present study. They were performed using IBM SPSS Statistics, Version 29.0, IBM Corp. (Armonk, NY, USA), 2022.

3. Results

3.1 Socio-demographic characteristics of the sample

A total of 75 participants were included in this exploratory study: 79% of whom were women and 21% were men. The median (interquartile range (IQR)) age of the studied population was 36 (24 to 53) years (Fig. 1).

As professional status, 80% were employed or students (n = 60), and 20% were unemployed (n = 6) or retired (n = 9) (unemployed/retired n = 15). Regarding family charge, 37.3% of participants had a family charge (n = 28), whereas 62.7% (n = 47) did not (**Supplementary Table 1**).

3.2 GAD-7 score

Regarding anxiety scores, 25% (n = 19) of the participants presented minimal anxiety, while 36% (n = 27) had mild anxiety, 28% (n = 21) had moderate anxiety, and 11% (n = 8) had severe anxiety.

A significant difference ($p < 0.05$) was observed in the anxiety score based on the age group (**Supplementary Table 1**).

3.3 PHQ-9 score

For depression symptoms, 69% (n = 52) of the participants scored higher than the cutoff points for depression, indicating the presence of mild (26.5%, n = 20), moderate (31%, n = 23), moderately severe (9%, n = 7), and severe depression (2.5%, n = 2). 31% (n = 23) of the participants showed minimal signs of depression (**Supplementary Table 1**).

No significant difference was observed between the different socio-demographic characteristics in the depression score.

3.4 GCPS score

For disability and pain scores, 50.5% of the participants were rated grade 1 (n = 38), 26.5% grade 2 (n = 20), 9.5% grade 3 (n = 7), and 13.5% grade 4 (n = 10). Around 51% of women and 50% of men accounted for grade 1 which represents low

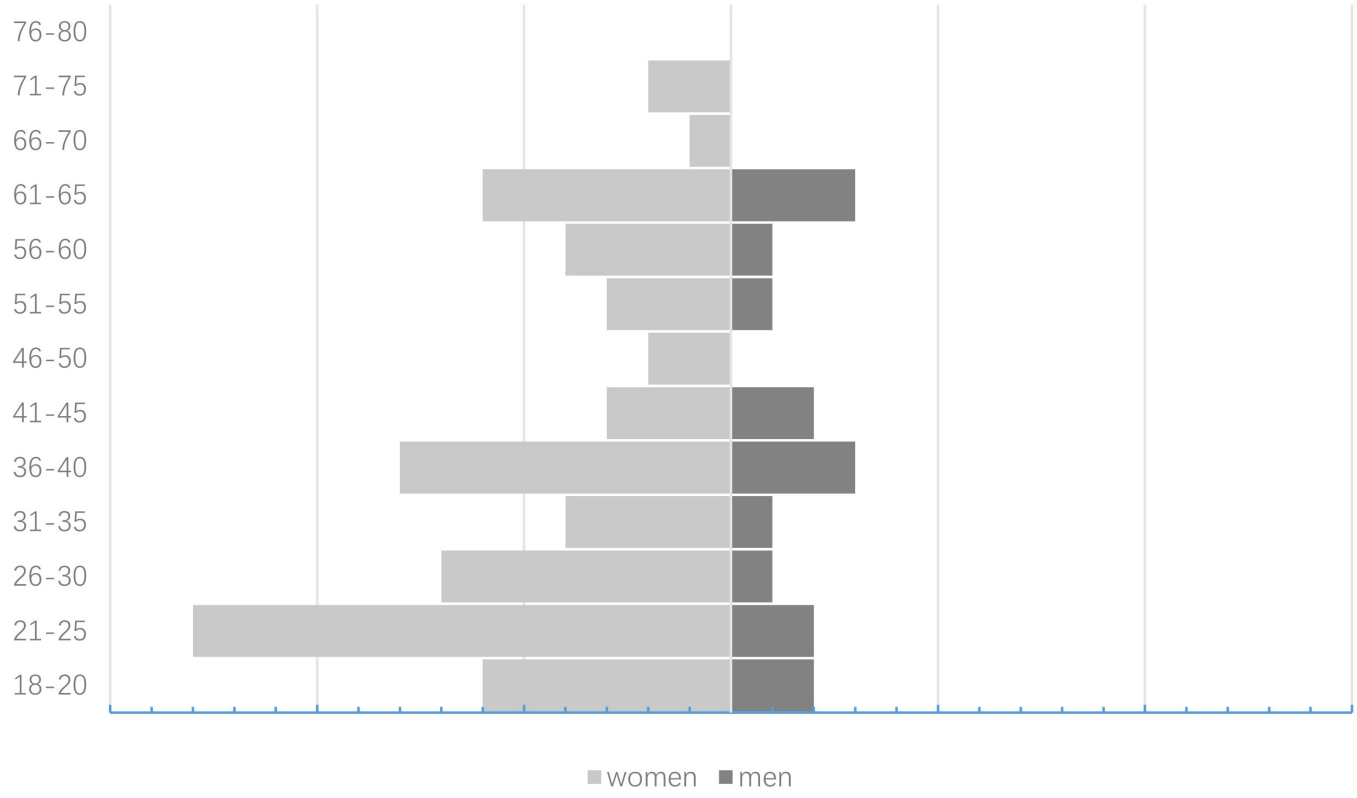


FIGURE 1. Age pyramid representing the study population (median (IQR) age for female 35 (23 to 52), median (IQR) age for male 39 (26 to 54)).

disability and low intensity of pain. Around 27% of women and 25% of men accounted for grade 2 and had complaints defined as high intensity and low disability. High disability and related moderately or severely limiting complaints were reported by 22% of women and 25% of men.

A significant difference ($p < 0.05$) was observed based on the family charge for the pain score (**Supplementary Table 1**).

3.5 Correlations between anxiety, depression, and pain

When we considered the entire study population, strong correlations were observed between GAD-7 and PHQ-9 ($r = 0.65$; 95% CI, 0.50 to 0.77), and between pain and disability ($r = 0.60$; 95% CI, 0.43 to 0.73). A moderate correlation was observed between PHQ-9 and disability ($r = 0.53$; 95% CI, 0.33 to 0.68) (Table 1).

When we focused on the different socio-demographic variables, we found strong correlations between GAD-7 and PHQ-9 in all groups except in the ≤35 age group. We also observed strong correlations between PHQ-9 and disability in the over-35 age group ($r = 0.69$; 95% CI, 0.47 to 0.83), in the unemployed/retired group ($r = 0.64$; 95% CI, 0.18 to 0.87), and in the "with family charge" group ($r = 0.65$; 95% CI, 0.35 to 0.83). Strong correlations between CPI and disability were found in females ($r = 0.62$; 95% CI, 0.42 to 0.76), in the 35 and under age group ($r = 0.60$; 95% CI, 0.33 to 0.78), in the employed group ($r = 0.62$; 95% CI, 0.43 to 076), and in the "with family charge" group ($r = 0.66$; 95% CI, 0.35 to 0.83). Numerous moderate correlations were also observed, as shown on **Supplementary Table 2**.

4. Discussion

Pain is the most commonly reported symptom of TMDs and the relief of pain is the reason for the patient to seek treatment [24]. Acute to chronic transition is frequent in TMDs. The present study focused on chronic pain, that is, as defined by the International Association for the Study of Pain (IASP), pain lasting for more than 3 months [29]. It has been suggested that the temporal criterion (increased to 6 months in some studies [11]) was not the most suitable to define chronic pain and that features of chronic pain states (*i.e.*, emotional distress, disabling effects) should be used to address the complexity of chronic pain [30]. Nevertheless, long-standing pain cases might express more psychological distress.

Levels of anxiety and depression are higher in TMD patients when compared with the general population [12, 20, 24]. In a study using GAD-7 and PHQ-9 to evaluate anxiety and depression before and during COVID pandemic in France, mean anxiety scores were 1.96, 2.37 and 2.82 at pre-lockdown, and during the first and second lockdowns, respectively. Mean depressive scores were 3.12, 3.36 and 3.95, respectively [31]. These scores of the general French population are below the threshold for mild anxiety and depression. Psychological factors are an important variable in the maintenance of chronic pain [24]. Anxiety and depression have, therefore, significantly higher levels in chronic TMDs than in acute TMDs [11] and even higher levels when disability is observed [19, 32, 33]. The acute to chronic pain transition is also more frequent when a pain-related disability exists [11]. Chronic pain patients are more affected in their psychosocial activities, which increases pain-related impairment [30], leading to a vicious circle. It has been shown that people with chronic TMD-related pain consequently exhibited greater psychosocial maladjustment [18].

In the present study, 23% of the subjects presented a high pain-related disability (Grade III or IV for GCPS score). This rate is above those shown in other studies [21, 26, 32], but aligns with those of most of the studies focusing on chronic pain or referred patients [23, 32, 34]. The GCPS-related disability scoring has been shown to be useful to screen individuals with clinically relevant psychosocial impairment [33]. No gender difference was highlighted in GCPS scores, in accordance with other studies [32]. However, the population we studied showed, along with all TMD studies, a strong female predominance [4, 20, 33].

Moreover, 31% of the population revealed a moderate depression score and 12% a moderate-severe or severe depression score. Other studies of TMD patients showed a range of 12.8–25% for moderate depression and 6.6–30% for severe depression [21–23, 25, 26, 35]. The fact that moderate depression scores are slightly higher than those in other studies may be due to differences in the scales used and the studied population, which consisted in this study exclusively of chronic pain patients.

Higher levels of depression and pain-related disability had been observed in older patients [36], but these features were

TABLE 1. Correlation coefficients between anxiety, depression, disability and pain scores.

All Subjects (n = 75)	GAD-7	PHQ-9	GCPS	
			Pain	Disability
GAD-7	1			
PHQ-9	**0.65 [0.50, 0.77]**	1		
GCPS				
Pain	*0.31 [0.09, 0.51]*	0.40 [0.17, 0.57]	1	
Disability	*0.36 [0.13, 0.54]*	0.53 [0.33, 0.68]	**0.60 [0.43, 0.73]**	1

GAD-7: Generalized Anxiety Disorder-7; PHQ-9: Patient Health Questionnaire-9; GCPS: Graded Chronic Pain Scale.
r [95% CI]: Italicized numbers represent a weak correlation ($0.40 \leq r \leq 0.49$), regular numbers represent a moderate correlation ($0.50 \leq r \leq 0.59$), bolded numbers represent a strong correlation ($0.60 \leq r \leq 0.79$).

not found in our population. Similarly, gender differences had been shown in depression scores [20] that were not in our study. The absence of statistically significant findings between genders should be interpreted with caution, as true differences may exist but could not be detected within this sample size.

Disability was correlated with PHQ-9 in our study, especially for the "with family charge", "unemployed/retired" and ">35" groups. This is in accordance with other research where higher levels of pain-related impairment were associated with severe scores of depression and CPI, demonstrating the mediation effect of pain in the intensity level of emotional disorders [17, 32, 34]. Depression was, thus, suggested as the best predictor of pain-related disability in TMD patients [34].

Depression amplifies pain perception and reduces the body's ability to modulate pain. Sleep disturbances and negative expectations associated with depression also contribute to shaping chronic pain and disability by reducing coping capacity. Conversely, anxiety is characterized by hyperarousal which can disrupt functioning, but is less likely to result in physical disability [14]. Anxiety, therefore, seems to play a lesser role than depression in chronic pain [13, 19]. Nevertheless, pain characteristics might be modulated by anxiety and a disposition to be anxious seems to be a significant risk factor for TMD. Patients with generalized anxiety disorder also report heightened muscle tension, along with sleep disturbances, restlessness, impaired concentration, and a higher incidence of chronic pain [21]. Notably, 25% of the population studied showed a minimal anxiety score, whereas 11% suffered from severe anxiety. A significant difference was also observed based on the age group in the anxiety score, with higher scores of anxiety for older subjects. Anxiety was also strongly correlated with depression in all groups except in the 35 and under age group. The perception and moderation of psychological distress might be shaped by the effects of personality and coping strategies. Young adulthood represents a unique developmental period when individuals are traditionally expected to assume responsibilities. Adopting problem-solving coping strategies could lessen the psychosocial and physical stress related to TMDs in this age group [37]. Another hypothesis that may account for this finding is that the younger participants' pain experience, although classified as chronic, may have been of shorter duration than that of the older participants. A recent review demonstrated that the occurrence and severity of anxiety and depression were increased among patients suffering from myofascial pain [17]. Anxiety can indeed potentiate the hyperactivity of masticatory muscles, resulting in TMJ overload and pain [3]. We chose though to conduct our study regardless of the Axis I diagnoses of TMDs, as it had already been shown that the correlation between Axis I diagnoses and pain-related impairment was not significant in the patient populations [25, 26].

Besides age and gender, we analysed the familial and professional status of participants, considering socio-demographic data offers insights on the level of chronic stress exposure, availability, and quality of social support. Socio-demographic data are less studied, showing conflicting results [26], but have been identified as factors influencing the development of TMD symptoms [38]. No significant association had been shown between marital status and TMD symptoms in two studies [39, 40]. Another study showed that divorced individuals reported higher intensity pain, followed by married ones [4]. We chose not to use the marital status itself because we aimed, using the "with/without family charge" groups, to aggregate data into two categories and to highlight the household and any dependent children more than civil status. We recognize that family charge cannot be limited to merely having a child living under the same roof and that our choice fails to capture the complexity of numerous family circumstances and many domestic stressors such as elder care, especially in the >35 age group. However, we demonstrated a significant difference between the two groups for the GCPS scores: the "with family charge" group exhibited higher scores. We also highlighted a stronger correlation between depression, pain, and disability scores in the "with family charge" group. The evaluation of social factors is challenging because study groups differ in their countries' living standards and the corresponding levels of public awareness. This difficulty is further compounded by the absence of standardized tools capable of assessing these factors as objectively as possible [27].

The socioeconomic situation is even more challenging to estimate. Studies [4, 26, 27, 32, 40] have used the level of education and/or the employment and/or the household income, a more or less taboo topic in some cultures or countries including France. Health behaviors, psychosocial factors, pain perception, and adherence to treatment may all act as mediators in the relationship between educational level and TMDs [4]. Some studies have shown that a higher educational level could be a risk factor for TMDs and others have shown that a lower level of education was associated with a higher pain level [4], but these studies included TMD patients without considering the acute or chronic definition of pain.

In most instances, no association was found between education or socioeconomic groups and pain-related TMD [32, 40]. Our study exhibited that the "unemployed/retired" group had a stronger correlation between the depression score and the anxiety and disability scores. These conflicting results may be due, as proposed by other authors [26, 40], to the influence of social support that, in some countries, equalize standards of living and access to healthcare. Our decision to combine two groups of individuals without employment status who may nevertheless differ in their living and social circumstances may also represent a limitation in the interpretation of the results.

This suggests that our findings may reflect, at least in part, universal psychosocial mechanisms linking unemployment to mental and physical health outcomes. However, sociocultural factors and differences in healthcare systems may also modulate these relationships.

The present study, to the best of our knowledge, is the first to deal with French TMD-patients' scores of pain, anxiety, and depression. The existence of cultural differences may influence the cognitive aspects of the pain experience [30], and as a result the expression of TMD may vary around the world [19, 23, 33]. Beyond this, the expression of emotional distress can vary between cultures. For example, in Poland, depression can be considered a stigma and be under-reported by patients [36]. The results of a study in one geographic area are not necessarily transferable to those of other areas.

Our study, as many others [33], presented a recruitment

bias because it was conducted in a unit specialized in TMD treatment. Most patients were referred by other treatment providers and the pathway of patient referral could result in a higher prevalence of patients with long-lasting pain. It had been shown that 75% of patients in TMDs specialized centers presented with chronic pain [30]. Psychosocial impact of TMD pain is on average less pronounced in primary health care [33]. That is why we chose to specifically consider these patients. Chronic TMD-related pain patients, who constitute a large portion of those in specialized centers, must be screened and a dual treatment approach, targeting both pain and suffering must be used. This is made possible through a multidisciplinary team (patient-centred care network made of dentists, psychologists, physiotherapists, neurologists, *etc.*) and multimodal biopsychosocial and personalized treatment methods which cannot in any way be limited to a mechanical approach [4, 24, 32, 33]. To account for pain related solely to TMD, we had to exclude patients with other diagnoses that could explain orofacial pain. This significantly reduced the size of the study population. This study should be carried out on a larger sample size and in a multicenter setting to ensure a more reliable representation of the French population and more significant results. Additional data regarding participants' lifestyle factors, including smoking habit, physical activity, and also medication intake, could also be collected.

We could have used additional measurement scales (*e.g.*, trait anxiety, somatization, catastrophism, sleep dysfunction), but this exploratory study was conducted under realistic clinical practice conditions, which aligns with the philosophy of the DC-TMD. PHQ-9 and GAD-7 are recommended tools to assess the emotional functioning of TMD patients and assist clinicians, without specific training in mental health, to identify patients with depression and anxiety [23].

An additional factor worth considering would have been post-traumatic stress disorder (PTSD), as painful TMD has been shown to be more prevalent among patients with severe PTSD, and greater PTSD symptom severity has been associated with more severe TMD pain. PTSD is also highly associated with sleep disturbances and negative expectations that contribute to depression. Therefore, assessing trauma exposure and PTSD symptoms in patients with painful TMD, and considering trauma-focused interventions as part of their treatment plan, may be important [41], particularly in specific populations such as veterans [42]. More broadly, understanding the patient's emotional state through the use of available assessment tools contributes to selecting appropriate treatment modalities.

Like other chronic pain conditions, TMD must be approached from a perspective that includes not only the physical aspect, but also the psychosocial dimension. Psychosocial factors have an impact on the different levels and progression of TMD. They impact the onset, the chronification, and the response to and benefit of treatment [18, 22, 23, 25, 30, 35]. Some authors, therefore, consider them as a relevant prognostic factor [35], better predictors than physical findings [32]. Pain-related disability would also negatively impact treatment success [23].

Early intervention significantly reduces the transition to chronic pain and the prevalence of emotional distress in high risk patients [12, 43]. Emphasis must consequently be placed on the education of general dental practitioners so they can give behavioral advice at the first onset of significant symptoms. This approach could in the future potentially decrease the number of patients consulting with longstanding TMD-related pain, all the more difficult to treat as the histories are lengthy and *de facto* associated with emotional distress.

The exploratory design, small sample size, limited geographic scope, lack of data on potential confounders, and the grouping of heterogeneous individuals in this study may limit the interpretation and generalizability of the findings.

5. Conclusions

This exploratory observational study aimed to evaluate pain intensity, pain-related disability, anxiety, and depression in a population of French adults with chronic TMD in relation to sociodemographic factors. It notably contributes to improving the understanding of these correlations as the French population had, to the best of our knowledge, never been studied before. This study revealed higher anxiety scores among older participants and higher GCPS scores in the "with family charge" group. Significant correlations between anxiety and depression scores were identified across all age groups, with the exception of participants younger than 35 years. Nevertheless, given the small sample size typical of this exploratory study, results should be interpreted cautiously. Their potential clinical significance requires confirmation through larger-scale studies.

AVAILABILITY OF DATA AND MATERIALS

The data are contained within this article.

AUTHOR CONTRIBUTIONS

MS and AB—designed the research study; analyzed the data. VV, AL, MS and FG—performed the research. MS and VV—wrote the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study has been approved by the CESREES (Ethics and Scientific Committee for Research, Studies and Evaluations in the field of health—Health Data Hub F20230324112741) and registered to the French data protection authority (2229520v0). Patient informed consent was obtained after appropriate information.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found, in the online version, at https://files.jofph.com/files/article/21207658129542840 32/attachment/Supplementary%20material.docx.

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