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Prevalence and Interplay of Hypervigilance and Kinesiophobia in TMD Patients: Implications in Clinical Outcomes

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ABSTRACT

Background: Behavioural cognitive factors, like kinesiophobia and coping skills like hypervigilance, may contribute to a worse prognosis of TMD symptoms. However, there is a lack of evidence about the prevalence and relationship of hypervigilance and kinesiophobia with TMD.

Objective: This study aimed to assess the prevalence and associations of hypervigilance and kinesiophobia in TMD.

Methods: The sample consisted of 233 participants, divided into the TMD group (133) and a control group (100). The following instruments were used: diagnostic criteria for temporomandibular disorders (DC/TMD), Pain Vigilance and Awareness Questionnaire (PVAQ), and Tampa Scale for kinesiophobia/temporomandibular joint dysfunction (TSK/TMD). Pain pressure threshold (PPT) was measured on the masticatory muscles and the temporomandibular joint. Mandibular movements were assessed with a millimetre ruler. Mann–Whitney *U* test was used for group comparisons and Spearman's correlation test for association analyses.

Results: The TMD-group showed higher hypervigilance and kinesiophobia values,and lower PPT and mandibular movement (opening and protrusion) values compared with controls ($p<0.05$). Also, a positive moderate correlation between hypervigilance and kinesiophobia ($p=0.000001$), a significant negative correlation between hypervigilance and PPT ($p=0.00001$) and a significant negative correlation between hypervigilance, kinesiophobia and mandibular movements ($p<0.05$) in the TMD-group were found. A positive weak correlation was found just between hypervigilance and kinesiophobia in the control group ($p=0.01$).

Conclusion: TMD patients present high levels of kinesiophobia and hypervigilance, which in turn are correlated and affect TMD symptoms.

1 | Background

Temporomandibular disorders (TMD) encompass a wide range of musculoskeletal conditions that affect the temporomandibular joint, masticatory muscles and related structures [1]. It affects 34% of the world's population [2], with women being up to twice as affected as men [2–5]. Although the precise cause of TMD remains unclear, psychological factors, pain amplification, general health and overall symptomatology are believed to contribute to the development of painful TMDs [6, 7]. Consequently, TMDs are biopsychosocial in nature, indicating that they result from a combination of several risk factors, including autonomic responses, genetic predispositions and psychosocial influences [8–12].

TMDs are frequently associated with psychological distress and behavioural changes [13–15]. The literature has reported that in TMD patients the prevalence of moderate to severe levels of somatization and depression, often associated with chronic pain and low disability, is approximately 28.5%–76.6% and 21.4%–60.1%, respectively [16]; as well as higher levels of anxiety and more frequent stress symptoms compared to controls. However, the association between psychosocial impairment and TMD seems to be bi-directional [17–19]. Additionally, behavioural cognitive factors, such as kinesiophobia and coping skills such as hypervigilance, may also contribute to TMD symptoms [20, 21].

Hypervigilance is defined as cognitive, physiological and behavioural patterns in which an individual either responds to neutral or ambiguous stimuli as if they were threatening or is enhanced in their detection and reaction to threatening or threat-related stimuli [22, 23]. Hypervigilant individuals pay excessive attention to pain and constantly scan their bodies for somatic and painful sensations. Additionally, as hypervigilance is linked to fear experience, and persistent pain like TMD pain can cause fearful behaviour as well, understanding their relationship is important for individualised treatments. In addition, once the fear system of pain or (re)injury is activated, it increases the individual's attention and concern in escaping and avoiding pain, generating an "avoidance" behaviour that in turn could result in the development of kinesiophobia [24].

Kinesiophobia is an excessive fear of movement and physical activity, resulting from a feeling of vulnerability to painful injury or fear of further injury, leading to avoidance of movement or activity [25]. Clinical trials have reported higher levels of kinesiophobia in TMD patients compared with controls [21]. In addition, avoiding jaw movement leads to abnormal movement patterns, which can contribute to an increase in problems related to jaw function [26]. Furthermore, long-term kinesiophobia results in greater physical disability, catastrophic thoughts and, consequently, higher levels of pain. This is because the experience of fear related to "avoidance" behaviour reinforces negative thoughts, which can generate a phobic state, with exacerbation of fear and increased perception of pain which could also lead to the development of hypervigilance [27].

In a study evaluating patients with low back pain who fear (re)injury, patients also presented hypervigilance to pain, which in turn accelerated the escape/avoidance behaviour [28]. Additionally, studies assessing populations with other chronic pain conditions found positive associations between pain surveillance and kinesiophobia and higher levels of pain sensitivity through pain pressure threshold (PPT) evaluation. Since hypervigilance and kinesiophobia can influence signs and symptoms of TMD [16, 29, 30] and considering that TMD patients also present lower levels of PPT, it could be expected that there is an association of hypervigilance and kinesiophobia in TMD patients [28].

However, there is still a lack of evidence about the relationship of hypervigilance and kinesiophobia in TMD patients, and with clinical parameters. Thus, the aim of this study was to assess the prevalence and associations of hypervigilance and kinesiophobia in TMD patients and their associations with PPT levels and jaw movements.

2 | Methods

This cross-sectional observational research received approval from the Research Ethics Committee of Egas Moniz School of Health and Sciences (#1273) and CUF TEJO Hospital (33956737/2023). All participants were informed about the research objectives and provided written consent to participate in the clinical trial. The study took place at the Egas Moniz Dental Clinic and the CUF TEJO Hospital from December 2023 to April 2024 and adhered to the Helsinki Declaration. The reporting of data followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline [31].

2.1 | Participants

The sample was obtained from Portuguese individuals seeking regular dental (healthy control group) or TMD treatment at Egas Moniz Dental Clinic and CUF Tejo Hospital.

Inclusion criteria were volunteers of both sexes, aged between 20 and 50 years, with or without diagnosis of TMD, according to the Portuguese version of the diagnostic criteria for temporomandibular disorders (DC/TMD) [32] assessed by two calibrated dentists (kappa coefficient = 0.80) specialised in orofacial pain and with experience using the DC/TMD (6 years). Exclusion criteria were patients undergoing treatment or who had received previous treatments for TMD, undergoing orthodontic treatment, with dental and neuropathic pain, traumas to the face or neck, rheumatic and/or psychiatric diseases.

The sample size calculation, based on previous studies [33, 34] was performed using the variable kinesiophobia, with the G*Power 3.1.9.2 software (Düsseldorf, Germany) [33]. The following parameters were considered: a power of 0.95, a significance level of 0.05 and an effect size of 0.5. The calculation indicated the need for at least 88 participants per group. The actual power obtained with this sample size was 95.14%. The final sample was composed of 233 participants, divided into two groups: 133 in the TMD group and 100 healthy controls. Participants were assigned to the groups based on their initial TMD screening.

2.2 | Study Protocol

Participants were assessed once in this study. During this visit, they were screened based on the study's inclusion and exclusion criteria. Volunteers were first assessed through the TMD Screener, included in the DC/TMD, and only those with at least one positive answer were evaluated with the complete DC/TMD protocol [35]. Participants with no positive answers were allocated to the control group. It is noteworthy that the sensitivity and specificity of the TMD Screener are 99% and 97%, respectively, for correct classification of true positives and true negatives [35]. Then, volunteers were informed about the study protocol and assessment methods that included the Pain Vigilance and Awareness Questionnaire (PVAQ) [36], Tampa Scale for Kinesiophobia/TMD (TSK) Questionnaire [30, 37], Pressure Pain Threshold (PPT) [38] and Jaw Range of Motion [39].

2.3 | Outcomes

2.3.1 | PVAQ

The validated Portuguese version of the Pain Vigilance and Awareness Questionnaire (PVAQ) [40] was used to assess the hypervigilance of the volunteers. The PVAQ [41] is a self-administered questionnaire consisting of 16 items designed to measure attention to pain. Items are rated on a six-point scale (from 0 = never to 5 = always), and the final score is the sum of all individual items. Higher values reflect greater hypervigilance to pain. Its psychometric properties demonstrate good reliability (> 0.85) [36, 42].

2.3.2 | Tampa Scale for Kinesiophobia/TMD(TSK) Questionnaire

The validated Portuguese version of the Tampa Scale for Kinesiophobia/Temporomandibular Joint Dysfunction (TSK/TMD) [37] was used to assess the prevalence of kinesiophobia in the volunteers. The TSK/TMD [30] is a self-administered questionnaire consisting of 12 items designed to measure fear of jaw movement. Items are rated on a four-point Likert scale as follows: 1 "strongly disagree," 2 "disagree," 3 "agree," and 4 "strongly agree." Responses are summed to produce a total score, with higher values reflecting greater fear of movement. Its psychometric properties demonstrate good reliability (> 0.75) [37].

2.3.3 | Measurement of Pressure Pain Threshold (PPT)

PPT measurements were performed using a digital algometer (Kratos DDK-20) with a flat circular tip of 1 cm^2, through which a constant and increasing pressure of approximately 0.5 $kg/cm^2/s$ was applied. Three measurements were performed in the temporomandibular joint (TMJ/1 cm in front of the tragus), temporalis (1 cm behind the the final of the eyesbrows) and masseter (1.5 cm above the inferior mandibular line) muscles, and the arithmetic mean of the three measurements was considered the final PPT value for statistical analysis. The assessments were performed in the most painful site in the TMD group and in the dominant site in the control group. Before the test, participants were instructed to press a button connected to the device itself to indicate the moment at which the sensation of pressure transformed into a painful stimulus [38, 43]. Its psychometric properties demonstrate acceptable reliability (0.51–0.69) [44].

2.3.4 | Jaw Range of Motion

Mandibular movements were evaluated in accordance with the DC/TMD [39]. The DC/TMD Axis I includes a clinical examination of the range of mandibular movements. Participants were evaluated while seated in a dental chair, in a room with adequate lighting. Clinical measurements of the mandibular movements were made by using a millimetre ruler and included: pain-free opening, maximum unassisted and assisted opening, right and left lateral movements, and protrusion. This assessment presents a good reliability (> 0.79) [45].

2.3.5 | TMD Diagnosis

For the assessment of TMD diagnosis the DC/TMD was used. For correlation analysis, the number of articular diagnoses (arthralgia, disk displacement with reduction and disk displacement without reduction without limited opening), as well as the frequencies of arthralgia and myalgia (local myalgia and myofascial pain with referral) were used.

2.3.6 | Data Analysis

Data normality was tested using the Shapiro–Wilk test, whereas homogeneity of variances was assessed using Levine's test. As the data did not present a normal distribution, *U* Mann–Whitney was used for groups comparisons. Spearman's correlation test was used for association analyses. The strength of the association was interpreted as weak ($\pm 0.1 < rho < \pm 0.4$), moderate ($\pm 0.4 < rho < \pm 0.7$), high ($\pm 0.7 < rho < \pm 0.9$), and very high ($rho > \pm 0.9$) [46]. All statistical tests were performed with a significance level of 5%.

3 | Results

3.1 | TMD vs. Controls

The samples were composed of 233 Portuguese patients, 133 TMD participants (33.93 ± 9.5) and 100 healthy controls (33.58 ± 9.6). No significant differences in age were observed between the groups ($p > 0.05$); however, as expected, there was a higher prevalence of women in the TMD group ($p = 0.04$). The TMD group presented the following frequency of diagnosis: 34% ($n = 46$) disk displacement with reduction, 3% ($n = 5$) disk displacement without reduction without limited opening, arthralgia 13% ($n = 18$), local myalgia 19% ($n = 25$) and myofascial pain with referral 57% ($n = 77$). Almost half of the patients in the TMD group presented more than one diagnosis. The median (min–max) pain intensity of the TMD group was 63 (41–79) and 81% of the subjects in this group presented a pain duration ≥ 3 months. Also, compared to the control group, the TMD group presented higher levels of kinesiophobia and hypervigilance ($p = 0.00001$), significantly lower levels of PPT in the TMJ ($p = 0.00001$) and temporalis ($p = 0.0001$) and masseter muscles ($p = 0.03$), and lower values of opening and protrusion mandibular movements ($p = 0.00001$) (Table 1).

TABLE 1 | Comparisons of the assessed variables between TMD patients and controls (mean ± SD and %).

Groups	TMD ($n = 133$)	Controls ($n = 100$)	p
Age	33.93 ± 9.5	33.58 ± 9.6	0.9
Gender			
Men	36.8 (49)	48.0 (48)	0.13
Women	63.2 (84)	52.0 (52)	0.04*
Psychosocial variables			
Hypervigilance	45.66 ± 11.2	32.93 ± 14.4	0.00001*
Kinesiophobia	38.90 ± 11.8	18.70 ± 6.21	0.00001*
PPT			
Temporalis	1.28 ± 0.41	1.55 ± 0.50	0.00001*
TMJ	1.27 ± 0.58	1.47 ± 0.37	0.0001*
Masseter	1.19 ± 0.48	1.32 ± 0.44	0.03*
Jaw movements			
Pain free open.	38.66 ± 8.70	47.96 ± 5.29	0.00001*
Max. unasst. open.	42.79 ± 7.39	50.32 ± 6.02	0.00001*
Max. asst. open.	44.81 ± 6.87	51.65 ± 6.03	0.00001*
Right lateral	8.60 ± 2.59	8.30 ± 2.59	0.57
Left lateral	8.71 ± 2.64	8 ± 2.35	0.11
Protrusion	6.72 ± 2.53	8.25 ± 2.53	0.0001*

Abbreviations: Max. asst. open, maximum assisted opening; Max. unasst. open, maximum unassisted opening; PPT, pain pressure threshold; TMD, temporomandibular disorders; TMJ, temporomandibular joint.
*$p < 0.05$.

3.2 | Painful TMD and Non-Painful TMD

Regarding the TMD group, 105 participants had painful TMD and 28 had non-painful TMD. No significant differences in age were observed between the groups ($p < 0.05$). Painful TMD patients presented greater levels of hypervigilance ($p = 0.01$), lower PPT values for the TMJ and masseter muscle ($p = 0.00001$) and a significantly diminished mouth opening ($p = 0.00001$) and protrusion ($p = 0.0001$) when compared to non-painful TMD patients. Regarding kinesiophobia results, although the painful TMD group presented slightly superior results, no significant differences were found between groups (Table 2).

3.3 | Correlations Between Hypervigilance, Kinesiophobia, PPT and Jaw Movements in TMD and Controls

A significant positive moderate ($r = 0.62/p = 0.000001$) and weak ($r = 0.33/p = 0.001$) correlations were found between hypervigilance and kinesiophobia in the TMD and control groups, respectively. Also, significant negative weak and moderate correlations between PPT and hypervigilance were found for the assessed structures (temporalis: $r = -0.23/p = 0.01$; TMJ: $r = -0.34/p = 0.00001$; masseter: $r = -0.50/p = 0.00001$). Regarding kinesiophobia, a significant very weak negative correlation was found just for the masseter muscle ($r = -0.199/p = 0.042$). Additionally, significant negative weak and moderate correlations were found between all mandibular movements and both hypervigilance and kinesiophobia ($p < 0.05$). No correlations were found between hypervigilance and kinesiophobia with PPT and jaw movements in the control group (Tables 3 and 4).

TABLE 2 | Comparisons of the assessed variables between painful and non-painful TMD diagnoses.

Groups	Painful TMD ($n = 105$)	Non-painful TMD ($n = 28$)	p
Psychosocial variables			
Hypervigilance	46.85 ± 11.8	41.41 ± 7.6	0.01*
Kinesiophobia	40.33 ± 10.9	38.90 ± 11.8	0.49
PPT			
Temporalis	1.25 ± 0.42	1.38 ± 0.37	0.1
TMJ	1.18 ± 0.61	1.56 ± 0.36	0.00001*
Masseter	1.09 ± 0.42	1.52 ± 0.49	0.00001*
Jaw movements			
Pain free open.	36.48 ± 8.16	45.90 ± 6.34	0.00001*
Max. unasst. open.	41.37 ± 7.17	47.96 ± 5.72	0.00001*
Max. asst. open.	43.77 ± 6.84	48.73 ± 5.62	0.00001*
Right lateral	8.49 ± 2.76	9.0 ± 1.75	0.12
Left lateral	8.63 ± 2.72	9.0 ± 2.30	0.34
Protrusion	6.25 ± 2.21	8.3 ± 2.93	0.0001*

Abbreviations: Max. asst. open, maximum assisted opening; Max. unasst. open, maximum unassisted opening; PPT, pain pressure threshold; TMD, temporomandibular disorders; TMJ, temporomandibular joint.
*$p < 0.05$.

3.4 | Correlations Between TMD Diagnosis, Hypervigilance and Kinesiophobia

Regarding hypervigilance, a significant positive moderate correlation was found for the number of articular TMD diagnoses ($r = 0.41/p = 0.00001$), and a negative and positive weak correlations for non-painful ($r = -0.22/p = 0.01$) and arthralgia diagnoses ($r = 0.31/p = 0.001$), respectively. Furthermore, a significant positive moderate correlation was also found just between kinesiophobia and the number of joint TMD

TABLE 3 | Correlations among hypervigilance, kinesiophobia, PPT (kg/f) and mandibular movements (mm) in the control group.

		Hypervigilance	Kinesiophobia
Psychosocial variables			
Hypervigilance	Spearman's rho		0.33
	p		0.001*
Kinesiophobia	Spearman's rho		—
	p		
PPT			
Temporalis	Spearman's rho	−0.04	0.12
	p	0.709	0.266
TMJ	Spearman's rho	−0.02	0.04
	p	0.826	0.711
Masseter	Spearman's rho	−0.02	0.12
	p	0.815	0.08
Jaw movements			
Pain free open.	Spearman's rho	−0.07	−0.05
	p	0.510	0.620
Max. unasst. open.	Spearman's rho	−0.06	−0.02
	p	0.575	0.880
Max. asst. open.	Spearman's rho	−0.15	−0.05
	p	0.154	0.640
Right lateral	Spearman's rho	−0.12	0.03
	p	0.267	0.757
Left lateral	Spearman's rho	−0.04	0.06
	p	0.729	0.548
Protrusion	Spearman's rho	0.01	0.03
	p	0.924	0.769

Abbreviations: Max. asst. open., maximum assisted opening; Max. unasst. open., maximum unassisted opening; PPT, pain pressure threshold; TMJ, temporomandibular joint.
*$p < 0.05$.

diagnoses ($r = 0.46$, $p = 0.000001$) (Table 5). No correlations were found between hypervigilance, kinesiophobia and myalgia ($p > 0.05$).

4 | Discussion

The main findings of this study show that TMD patients present higher levels of hypervigilance and kinesiophobia than controls. In addition, patients with painful TMDs have significantly higher levels of hypervigilance and lower PPT and mandibular movement values, but no higher levels of kinesiophobia when compared to non-painful TMDs. Further, our study also shows that there is a moderate correlation between hypervigilance and kinesiophobia in TMD, which is weak for controls. Notwithstanding, only the number of articular TMD diagnoses and mandibular movements were the clinical parameters significantly correlated with both hypervigilance and kinesiophobia.

The finding of this study indicating that patients suffering from TMD display a significantly higher degree of kinesiophobia than controls is not surprising, and is in accordance with several previous studies in this patient group. For instance, in a study examining masticatory performance in individuals with painful muscular TMD, participants demonstrated markedly higher kinesiophobia compared to healthy, pain-free controls [47]. Additionally, research on the emotional and functional states of TMD patients revealed similarly elevated kinesiophobia levels within this group [21]. Furthermore, three additional studies indicated that the heightened kinesiophobia experienced by TMD patients not only exacerbates

TABLE 4 | Correlations among hypervigilance, kinesiophobia, PPT (kg/f) and mandibular movements (mm) in the TMD group.

		Hypervigilance	Kinesiophobia
Psychosocial variables			
Hypervigilance	Spearman's rho		0.6238
	p		0.000001*
Kinesiophobia	Spearman's rho		—
	p		
PPT			
Temporalis	Spearman's rho	−0.2382	0.0924
	p	0.0149*	0.3508
TMJ	Spearman's rho	−0.3415	−0.0672
	p	0.00001*	0.4979
Masseter	Spearman's rho	−0.5051	−0.1998
	p	0.00001*	0.0420*
Jaw movements			
Pain free open.	Spearman's rho	−0.3680	−0.3826
	p	0.00001*	0.00001*
Max. unasst. open.	Spearman's rho	−0.4093	−0.5732
	p	0.000001*	0.000001*
Max. asst. open.	Spearman's rho	−0.2261	−0.4266
	p	0.02102*	0.00001*
Right lateral	Spearman's rho	−0.4365	−0.4127
	p	0.0000001*	1.34e-5*
Left lateral	Spearman's rho	−0.4215	−0.2696
	p	0.0000001*	0.00565*
Protrusion	Spearman's rho	−0.2623	−0.2501
	p	0.00714*	0.01044*

Abbreviations: Max. asst. open, maximum assisted opening; Max. unasst. open, maximum unassisted opening; PPT, pain pressure threshold; TMJ, temporomandibular joint.
*$p < 0.05$.

TABLE 5 | Correlations between hypervigilance, kinesiophobia and TMD diagnosis.

		TMD			
		N/Articular	Non-Painful/Articular	Arthralgia	Myalgia
Hypervigilance	Spearman's rho	0.41	−0.22	0.31	0.12
	p	0.00001*	0.01*	0.001*	0.20
Kinesiophobia	Spearman's rho	0.46	−0.06	0.15	−0.04
	p	0.000001*	0.49	0.12	0.66

Abbreviations: N/articular, number of articular TMD diagnosis; TMD, temporomandibular disorders.
*$p < 0.05$.

functional jaw issues, as the diminished range of mandibular movements found in our study, and pain perception; but also diminishes their capacity to eat, chew and communicate effectively [26, 33, 48]. Our findings suggest that the relationship between TMD and kinesiophobia is established based on the coexistence of both painful and non-painful diagnoses.

We observed no significant differences in kinesiophobia levels between painful and non-painful TMD groups, a correlation between kinesiophobia and the number of articular diagnoses, and no correlation between kinesiophobia and arthralgia, myalgia or non-painful diagnoses. However, given the significant correlation found between hypervigilance and non-painful diagnoses, we hypothesise that the presence of clinical signs such as TMJ noises and patients' perception of these signs, which may lead to increased hypervigilance, could influence kinesiophobia levels in TMD patients [34]. This may provide a basis for explaining the relationship between these two variables. Nevertheless, this relationship requires further investigation, as another study reported significant differences in kinesiophobia levels between painful and non-painful TMD [33]. Collectively, these findings highlight the critical need to address kinesiophobia in both diagnostic evaluations and treatment strategies. By doing this, implementing psychological and behavioural interventions [49] that may mitigate avoidance behaviours will be possible, thereby enhancing the efficacy of conventional TMD treatments.

This study also highlights the higher degree of hypervigilance in the TMD group compared with controls and in painful TMDs compared to non-painful TMDs. As far as we know, this is the first study showing a high prevalence of hypervigilance in a large cohort of TMD patients compared to controls. However, if we also consider the significant correlation found between hypervigilance and non-painful diagnosis in the present study, our results are partially in line with a previous study indicating a strong correlation between hypervigilance and TMD, particularly those associated with pain, where patients with TMD have been shown to display a perceptual amplification of pressure stimulation no matter the intensity—from very gentle to strongly painful [50]. These amplified perceptions of bodily sensations lead to increased awareness and anticipation of pain, which in turn may exacerbate TMD symptoms, and could explain the negative weak, however significant correlation between PPT and hypervigilance in our TMD population. Further, there are indications that patients with TMD have alterations in brain regions associated with pain perception, i.e., awareness and anticipation of pain, indicating that these individuals may experience heightened responses to pain due to hypervigilance, thus intensifying their TMD symptoms [51, 52]. As for kinesiophobia, from a clinical as well as treatment perspective, the findings regarding hypervigilance further strengthen the necessity of investigating these factors when examining patients with painful TMDs, and also considering them in the treatment planning adding, for instance, psychological/behavioural treatment approaches, since they have been shown to increase the treatment efficacy of standard treatments of TMD [49].

The positive moderate correlation between hypervigilance and kinesiophobia found in this study is not surprising, since both conditions can separately result in an increase of chronification of pain by perpetuating a cycle of pain-related stress, anxiety, and catastrophizing thoughts and behaviour [16]. In addition, higher levels of kinesiophobia and hypervigilance have been reported in other chronic painful conditions such as low back pain and fibromyalgia [50, 53]. Hypervigilance leads patients to become acutely aware of any potential triggers for discomfort, reinforcing a state of anticipation and anxiety surrounding movement. This means that hypervigilance facilitates the detection of pain and pain-related information, and consequently is related to action tendencies of avoid [24]. This mindset fosters kinesiophobia where individuals avoid activities they fear could exacerbate their pain. There is also a possibility that pain evokes a higher degree of kinesiophobia in individuals hypervigilant to pain [24]. This vicious cycle between these two factors could explain the negative significant correlation found between them and mandibular movements reported in our study. Moreover, kinesiophobia is linked to increased pain sensitivity and chronic pain states, further complicating recovery efforts for those with TMD [21, 29]. Considering our results, we can propose that the relationship between hypervigilance and kinesiophobia could be stronger in patients with articular TMD diagnosis than with myogenous diagnosis.

Hence, by addressing hypervigilance through interventions like psychological/behavioural treatments, one can reduce kinesiophobia. This would, in turn, help to break the cycle of pain and fear that contributes to worsening TMD symptoms and improving quality of life for these patients by restoring functional movement and reducing pain intensity [21, 33]. Thus, a holistic approach to treatment underscores the importance of psychological/behavioural interventions in managing physical symptoms associated with TMD [16, 49, 52]. This is because standard treatments do not provide the patients with tools to handle their excessive attention to pain or amplified perception of pain [16]. Finally, for behavioural treatments, we recommend the inclusion of a detailed explanation of the disorder and its prognosis, the clinical significance of the signs and symptoms perceived by the patients, as well as challenging erroneous beliefs about pain or counselling to embrace the possibility of a fulfilling life even in the presence of pain [24], in order to avoid kinesiophobia and hypervigilance.

The main strength of our study lies in the clinical implication on treatment of the reported evident interplay between hypervigilance and kinesiophobia in TMD regardless of the presence of pain. It suggests that cognitive behavioural treatments, including patient education on the different aspects of TMDs, could benefit them. Further, these findings can also explain why psychological/behavioural interventions, as treatment of painful TMDs, are equally necessary as standard treatment for TMD and can also be seen as a promising treatment approach for this patient group [49].

This investigation has some shortcomings that could be addressed in future studies. First, the cross-sectional design, which precludes establishing any cause–effect relationship between the variables studied. Also, the absence of assessment of other variables that could influence the prevalence of hypervigilance and kinesiophobia such as catastrophization and concomitant chronic painful diagnosis. Moreover, the sample was drawn from a specific population (Portuguese), which may limit the generalisation of the results to broader populations, since the prevalence of TMD and psychological factors could differ between countries due to dissimilarities in socioeconomic variables [16, 54]. Finally, the absence of longitudinal measures prevents understanding how symptoms and behaviours evolve over time.

5 | Conclusion

This study underscores the high prevalence of kinesiophobia and hypervigilance in TMD patients and their significant relationship with articular TMD diagnosis. The findings suggest that heightened levels of hypervigilance can lead to an amplified fear of movement (kinesiophobia), exacerbating the pain and functional limitations associated with TMD.

Author Contributions

G.D.T.C., P.M.T.C.C. and P.M.M.M.A. were involved in study conceptualization and design; P.M.T.C.C., A.S.L., A.M.H. and L.M.P.C.C. were involved in clinical examinations and data collection; G.D.T.C., R.L.P, L.S.P. and N.C. were involved in data analysis, writing original draft, review and editing. All authors reviewed and agreed with the final version of the manuscript.

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The authors have nothing to report.

Ethics Statement

This study received approval from the Research Ethics Committee of Egas Moniz School of Health and Sciences (#1273) and CUF TEJO Hospital (33 956 737/2023). All participants provided a written consent to participate in the clinical trial.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

All data are available upon reasonable request to the corresponding author.

Peer Review

The peer review history for this article is available at https://www.webofscience.com/api/gateway/wos/peer-review/10.1111/joor.13997.

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