

## TEMPOROMANDIBULAR DISORDERS AND PSYCHOLOGICAL FACTORS: A LITERATURE REVIEW

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**ABSTRACT.** Temporomandibular disorders (TMD) are biological conditions that involve signs and symptoms, such as chronic pain in the temporomandibular joint and mastication muscles. This study aimed to identify which and how psychological concepts are described in articles on dental interventions related to TMD, in systematic review articles. For this, three databases were used in the search and selection: PubMed, Scopus and Web of Science. The same set of key words was applied to all these databases. Review articles published between 2000 and 2017, written in English, were selected. Of the 4,092 articles found, seven were selected describing psychological interventions related to TMD. All selected articles were analyzed based on their objectives and discussions, considering the presentation and understanding of psychological variables related to temporomandibular disorder and the interventions used. Qualitative and quantitative analyses were carried out. It can be concluded that the understanding and definition of psychological variables related to TMD are not evident, which makes it difficult to produce clear results on the effectiveness of diagnoses and interventions for TMD.

**Keywords:** Temporomandibular disorder; psychological factors; psychology.

## DISFUNÇÕES TEMPOROMANDIBULARES E FATORES PSICOLÓGICOS: UMA REVISÃO DE LITERATURA

**RESUMO.** As disfunções temporomandibulares (DTM) são condições biológicas que envolvem sinais e sintomas como dores crônicas na articulação temporomandibular e nos músculos da mastigação. O presente estudo tem como objetivo identificar quais e como conceitos psicológicos são descritos em artigos de intervenções odontológicas relacionadas à DTM, em artigos de revisão sistemática. Para isto foram utilizadas três bases de dados na busca e seleção: PubMed, Scopus e Web of Science. Aplicou-se em todas estas bases de dados a mesma formulação de termos-chave. Foram selecionados os artigos de revisões, publicados entre 2000 e 2017, escritos em inglês. Dos 4.092 artigos encontrados, sete foram selecionados descrevendo intervenções psicológicas envolvidas

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com o tratamento da DTM. Todos os artigos selecionados foram analisados com base em seus objetivos e discussões, considerando as características de apresentação e compreensão das variáveis psicológicas relacionadas à disfunção temporomandibular e às intervenções utilizadas. Para tanto, foram realizadas análises qualitativas e quantitativas. Pode-se concluir que a compreensão e a definição das variáveis psicológicas relacionadas à DTM não são evidentes, o que dificulta a produção de resultados claros sobre a eficácia dos diagnósticos e intervenções para DTM.

**Palavras-chave:** Disfunção temporomandibular; fatores psicológicos; psicologia.

## **DISTURBIOS TEMPOROMANDIBULARES Y FACTORES PSICOLÓGICOS: UNA REVISIÓN DE LITERATURA**

**RESUMEN.** Las disfunciones temporomandibulares (DTM) son condiciones biológicas que involucra signos y síntomas como dolores crónicos en la articulación temporomandibular y en los músculos de la masticación. El presente estudio tiene como objetivo identificar cuáles y cómo los conceptos psicológicos se describen en artículos de intervenciones odontológicas relacionadas con DTM, en artículos de revisión sistemática. Para ello se utilizaron tres bases de datos en la búsqueda y selección: PubMed, Scopus y Web of Science. Se aplicó en todas estas bases de datos la misma formulación de términos clave. Se seleccionaron los artículos de revisiones, publicados entre 2000 y 2017, escritos en inglés. De los 4.092 artículos encontrados, siete (07) fueron seleccionados describiendo intervenciones psicológicas involucradas con el tratamiento de la DTM. Todos los artículos seleccionados fueron analizados en base a sus objetivos y discusiones, considerando las características de presentación y comprensión de las variables psicológicas relacionadas a la disfunción temporomandibular ya las intervenciones utilizadas. Para ello, se realizaron análisis cualitativos y cuantitativos. Se puede concluir que la comprensión y la definición de las variables psicológicas relacionadas con la DTM no son evidentes, lo que dificulta la producción de resultados claros sobre la eficacia de los diagnósticos e intervenciones para DTM.

**Palabras clave:** Trastorno temporomandibulares; factores psicosociales; psicología.

### **Introduction**

Temporomandibular Disorder (TMD) is a change in stomatognathic system structures, considered as a set of three main signs and symptoms: pain in the temporomandibular joint (TMJ), or in the masticatory muscles; limited mandibular movements; and noises during TMJ movements (Dworkin, et al., 1990; Kotiranta, Suvinen, & Forssell, 2016). TMD is a frequent source for dental treatment searching, as well as treatments in other health areas (e.g., physical therapy, medicine).

The Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) is a reliable instrument for TMD clinical assessment. This instrument is divided into two axes, in which the first serves as a basis for the assessment involving TMD's physical factors (e.g., mouth opening, other functional aspects), while the second identifies psychological and social issues (e.g., depressive state, anxiety state, etc.) related to TMD (Dworkin, Korff, & Le Resche, 1992). Slade et al. (2007) claimed that accurate and valid diagnosis is still a

challenge in the dentistry field. This difficulty in systematizing the diagnosis is related to the high variability of patient perception and reporting pain arise from their own subjective experience, based on genetic, personal, and social factors (Slade et al., 2007; Orlando, Manfredini, Salvetti, & Bosco, 2007). Maydana, Tesch, Denardin, Ursi, and Dworkin, (2010) point out that diagnoses are descriptive and little analytical, mainly due to the lack of a clear understanding of the relationships between etiological factors and pathophysiological mechanisms.

The literature fails to show a clear understanding on what would be the main features of the TMD etiological processes. The cause of TMD has been considered as multifactorial and can occur in the entire population regardless of age and gender. It is usually associated with psychological factors, muscle hyperactivity, injuries, among other factors (Avrella et al., 2015). Several authors (De La Torre Canales et al., 2018; Dworkin et al., 1990; Maia et al., 2021; List & Jensen, 2017; Oral, Bal Küçük, Ebeoğlu, & Dincer, 2009; Slade et al., 2007; Sójka, Stelcer, Roy, Mojs, & Pryliński, 2018) have indicated that physiological and psychological variables can interact in the TMD etiology, but due to the disagreement in understanding this relation, further studies are required to delimit this interaction. Gameiro, da Silva Andrade, Nouer and de ArrudaVeiga (2006) argue that there is a need to consider psychological factors such as stress, depression and anxiety as causative agents of TMD. Slade et al. (2007), however, consider that the participation of psychological factors in temporomandibular disorders is unclear and poorly substantiated, thus it is unreliable to conclude whether these factors participate in the development, maintenance, or are a consequence of the disorder.

Although the unclear relationship between psychological variables and physical symptoms of TMD, several psychological interventions (characterized as non-invasive and low-cost) are recommended by authors in the field (Dworkin et al., 1990; Gameiro et al. 2006; Matsuoka et al., 2017; Slade et al., 2007). Dworkin (1994), for example, demonstrated the effectiveness of techniques derived from brief cognitive behavioral therapy for treating chronic pain. The authors assessed that this type of therapy can: 1. Increase the knowledge about the pain; 2. increase the adaptive repertoire of patients with pain; 3. train skills that can change the perception of pain and, consequently, the symptoms of this disorder. Psychological interventions present evidence on the attenuation of the pain experience, one of the most frequent causes for seeking dental care (Dworkin et al., 1990).

Informative psychological interventions (e.g., preparatory procedure, relaxation) are also used concurrently with dental techniques (e.g., use of an occlusal splint) in the treatment of TMD (Dworkin, 1994; List & Axelson, 2010). It is noteworthy that biofeedback, a technique that combines the use of physiological measures for teaching the discrimination of events that can produce pain, is presented as a facilitator for the development of coping repertoires for TMD symptoms (Crider, Glaros, & Gevirtz, 2005). However, the participation of psychological variables in the determination or treatment of TMD is also unclear for the literature especially in the field of psychology and dentistry.

Given this multiple understanding of psychological variables related to TMD (Oral et al., 2009; Maydana et al., 2011; Dworkin et al., 2002) and the difficulties documented by the authors in bearing the relationship between psychological variables and TMD, there are overlapping variables that make difficult the understanding of the relationship between psychological variables and TMD. The present review assessed data presented by systematic reviews that analyzed TMD intervention articles, developing an understanding of the current state of definitions and results of psychological variables involved in temporomandibular disorders. The present study aimed to identify psychological concepts

and how these are described in dental interventions related to TMD, in systematic review articles.

## **Method**

Three virtual databases were used for searching: PubMed, Scopus and Web of Science. The collection and selection of articles were divided into six stages, namely: 1. keyword, 2. filters, 3. selection by title, 4. duplications, 5. thematic categories, and 6. full articles.

In Step 1, descriptors that referred to Temporomandibular Disorder were used in English in order to expand the scope of searching. Through Boolean logical operators (AND and OR), the terms were combined with others referring to psychological factors. The combination of descriptors used was the same in the three bases, namely: (*temporomandibular\* OR "temporomandibular disorders" OR "temporomandibular joints"*) AND (*"psychological factors" OR psychological\* OR anxiety\* OR depression\* OR "psychological symptoms" OR "psychological distress" OR "psychologic distress"*) (step 1).

Step 2 selected articles based on pre-programmed filters. In order to expand the collection of data, the authors decided to search for literature review articles on dental and psychological intervention for TMD. Therefore, articles that were characterized as "review" (systematic or not), were selected through available filter tools in the databases. Step 2 also filtered articles published in English, between January 2000 and February 2017, ensuring an analysis consistent with the current state of research of this area.

Steps 3 and 4 selected articles that contained terms related to Temporomandibular disorder and excluded duplicate articles, respectively. Articles that do not show TMD-related terms in their titles were excluded from the sample. This procedure was performed to ensure that other disorders (e.g., burning mouth), that also involve the temporomandibular joint or problems related to orofacial pain, were not confused in the sample of articles. In addition, during this phase, all duplicate articles in the sample were excluded to avoid accounting for repeated data (Step 4).

Step 5 identified studies that addressed interventions by systematically reviewing the published literature considering psychological factors as dependent variables and psychological interventions as independent variables. Specific interventions, however, were not a criterion for selection, and standard dental procedures or multimodal treatments could be selected.

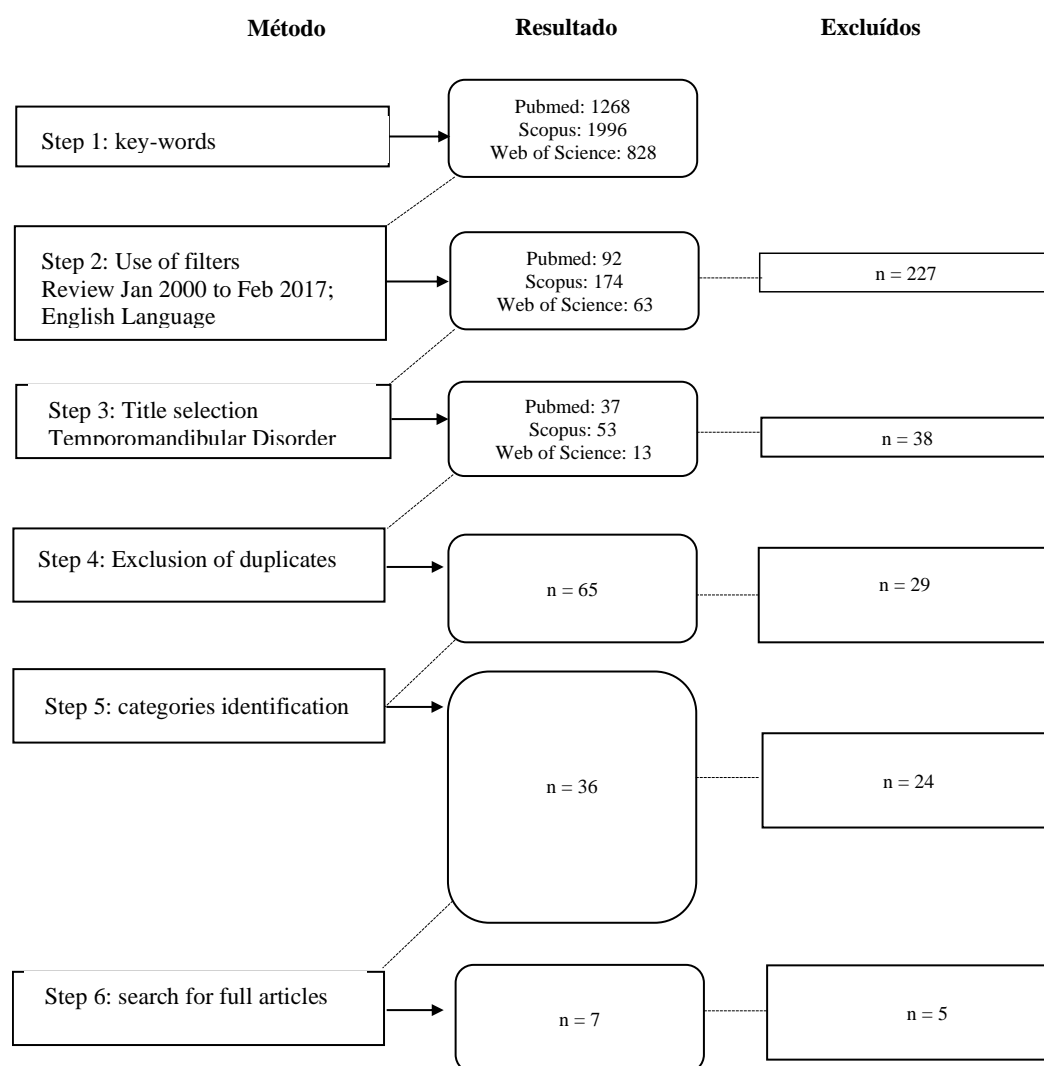
In the Step 6, all articles with open access were identified and selected. All articles that were unavailable, corrupted or that had some download error were excluded from the sample. Thus, the articles selected by the criteria proposed by this review were analyzed considering the aspects related to their respective objectives, methods and main results.

## **Results**

The results are presented in the following structure: 1. description of the main items of the selected systematic reviews (methodological and results analysis), 2. comparison between exclusive and repeated articles, 3. use of psychological measures and biological measures, and 4. description of identified psychological concepts. The term psychological measures was considered to be related to the use of formal psychological assessment instruments, while the term psychological concepts was considered to be the identification

of psychological variables (with or without their operational definition) as they were referred on the literature reviews analyzed.

The first search procedure resulted in 4,092 works published in the three databases. After using the databases filters, 3,763 studies were excluded. After this exclusion, from the 363 remaining studies, 103 studies were selected because their titles contained the term temporomandibular disorder. After identifying the themes and excluding duplicated articles, 12 reviews that analyzed interventions were selected. However, only seven of them were available in the databases. The summary of steps and results obtained for each step are specified in Figure 1.



**Figure 1.** Article Selection Flowchart for Each Step of the Procedure.

Table 1 presents a brief description of the analyzed reviews, the investigated interventions and also the results of the interventions of each study. The seven studies referring to literature reviews were analyzed based on the proposed objectives, designs, analysis of interventions and main results found.

**Table 1.** *Analysis of selected literature reviews.*

Authors, year, Number of articles	Objective of the review	Design Number of patients	Interventions	Results
Orlando, et al. 2007  n=19	Review of biobehavioral modalities for pain relief	Controlled clinical trial Number of patients: 1,590	CG: Usual Treatment I: Biobehavioral Modalities	CG ≠ I No direct comparisons.
Türp et al. 2007  n=11	Review of simple and multimodal management strategies in patients with TMD.	Randomized Clinical Trials Number of patients: 896	CG: Usual Treatment I: Multimodal therapy	CG = I, for pain, satisfaction, depression and distress.
Liu et al. 2012  n=5	Examine the effects of studies that used CBT for TMD.	Randomized Clinical Trials Number of patients: 485	CG: Usual Treatment I: Cognitive Behavioral Therapy	CG = I
Freitas, et al. 2013  n=7	Investigate the effectiveness of counseling and other self-management-based therapies in pain relief.	Controlled clinical trials; Number of patients: 489	CG: Intraocclusal Appliance I: Counseling	I > CG, for pain, sensitivity, and mouth opening.
Roldán-Barraza et al. 2014  n=12	Meta-analysis comparing the effects of occlusal splint therapy with psychosocial interventions.	Randomized Clinical Trials Number of patients: 1,132	CG: Usual Treatment I: Psychosocial intervention.	CG = I, for pain. I > CG, for subjective variables. CG > I, for physical variables.
Kotiranta et al. 2014  n=7	Systematic review of the benefits of tailored treatments for TMD.	<i>Tailored Treatment studies</i> Number of patients: 1,207	CG: Usual Treatment I: Tailored Treatment.	I > CG, for psychosocial variables.
Randhawa et al. 2016  n=7	Determine the efficiency and cost-effectiveness of non-invasive interventions for TMD	Randomized Clinical Trials Number of patients: 1,475	CG: Usual Treatment I: Cognitive Behavioral Therapy	CG = I, for pain and disability. I > CG, for depression

Table 1 lists nine identified interventions, seven were considered psychological or multimodal (biobehavioral modalities, multimodal therapy, cognitive behavioral therapy, counseling, psychosocial intervention), and only two were considered as usual in the dental context, accounted by Roldan-Barraza et al. (2014) as a combination of treatments common to the dental context that involve the use of occlusal splints, self-care, teaching, and medication use.

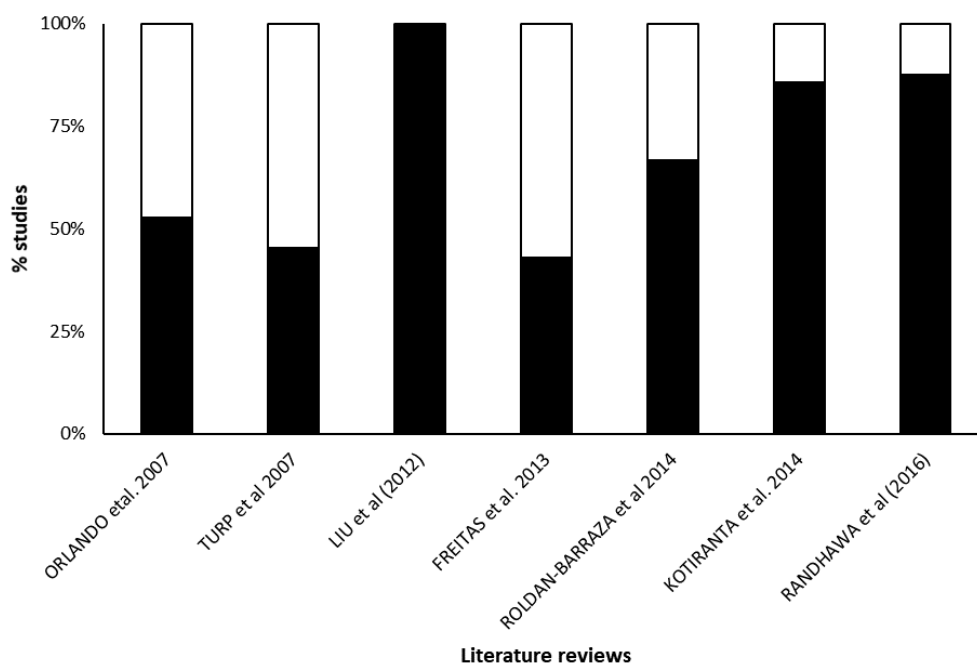
All reviews described studies with experimental group design. It is noteworthy that all articles presented revised studies that compared groups of patients undergoing usual treatments (control) and groups undergoing psychological or multimodal treatments. Among the psychological variables, pain and depression stand out as the most frequent among studies. The number indicated in the column *Design, diagnosis and number of patients* in

the table corresponds to the total number of patients evaluated, considering all the studies in each review, which varied between 485 and 1,590 among the studies.

The results of the studies evaluated in the analyzed reviews generally show that psychosocial interventions (so called by the authors) produced more expressive results for the dependent variables called subjective (e.g., somatization and depression), while usual treatments produced more significant improvements in physical symptoms of TMD (e.g. jaw opening) (Roldán-Barraza, Janko, Villanueva, Araya, & Lauer, 2014). This result was also reported by Kotiranta et al. (2014) and Randhawa et al. (2016).

Liu et al. (2012), Orlando et al. (2007) and Türp et al. (2007) concluded that psychological/psychosocial interventions and common clinical interventions produced similar results in TMD symptoms when compared to each other. De Freitas, Ferreira, Barbosa, and Calderon (2013) present a similar analysis (also Randhawa et al., 2016; Kotiranta et al., 2014), indicating positive results in subjective measures in the group of participants undergoing psychological interventions and better results in physical measures for groups undergoing usual therapy. However, it is noteworthy that these results could also be due to the participation of other forms of therapy (e.g., physical therapy) in TMD interventions.

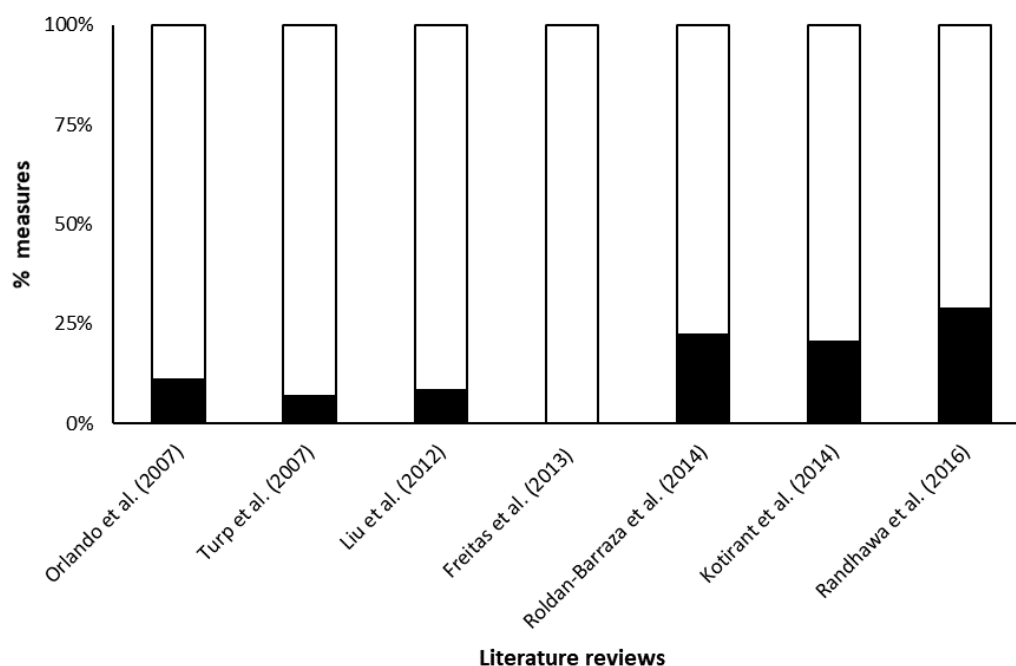
A total of 68 studies were analyzed by the seven literature reviews articles. However, only 25 articles listed were not repeated, that is, they were exclusive in their respective studies. Therefore, the proportion of repeated articles is equal to 0.63, which were analyzed one or more times between reviews (Figure 2).



**Figure 2.** Percentage of repeated and non-repeated articles in the literature reviews analyzed.

*Note.* Black bars represent the percentage of analyzed studies repeated among literature reviews. White bars represent the percentage of analyzed studies present in only one review.

Figure 2 shows the percentage of repeated references for each of the reviews. It can be observed that, in general, the number of exclusive references among reviews is less frequent when compared to the number of studies repeated among them. In the study by Liu et al. (2012), for example, all articles analyzed were found and analyzed in other reviews. This could be understood as a predictor of regularity in the analysis performed by the reviews, since the bases for these would be the same for most of the studies.



**Figure 3.** *Percentage of psychological (psi) and non-psychological (npsi) measures assessed by the selected studies.*

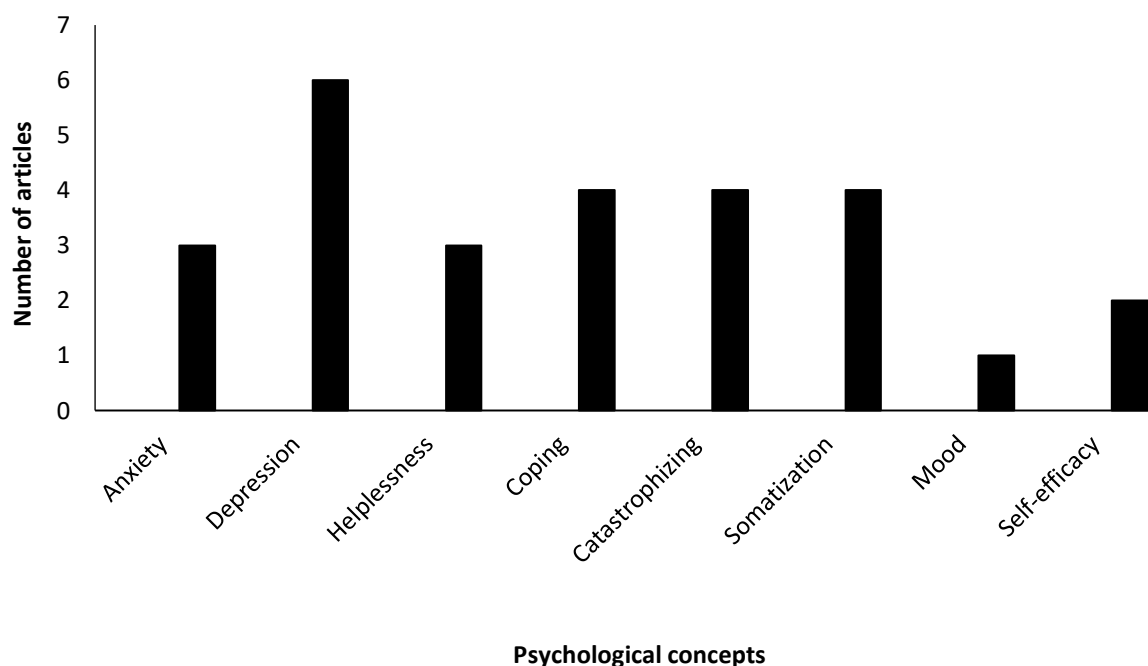
Note. Black bars represent the percentage of non-psychological measures, while white bars represent the percentage of psychological measures.

Figure 3 shows the percentage of psychological measures compared to the biological measures analyzed by the reviews. The use of biological measures, such as the evaluation of results in temporomandibular disorders, is noticeably more frequent. When comparing the number of psychological measures with other measures, there is a greater concentration of interest for biological measures, but there is an apparently increasing tendency in the last years for using specific psychological measures. The comparisons made by the authors were based on factors related to both physical measures (mouth opening, palpation, pain, etc.) and those considered psychological (depression, anxiety, mood, helplessness, coping, catastrophizing, somatization and self-efficacy). Despite the fact the pain is commonly considered as a psychophysical phenomenon, an unpleasant subjective experience composed of several sensory, motivational and behavioral aspects, in the present study, pain was considered a biological variable, due to the way the area of dentistry classifies it.

In Figure 4, it is possible to observe, for each psychological concept, the number of times it is addressed in the set of revisions. In this figure, it can be seen that depression was the most cited psychological concept in the analyzed reviews (in six out of seven this concept was mentioned). Three other concepts were found with equal frequency to each other: coping, catastrophizing and somatization (four reviews). On the other hand, the least



frequent concept was that of humoral states, which are represented by Orlando et al. (2007) as psychological states (e.g. depressive mood, anxious mood etc.). The frequency of the concepts of depression, coping, catastrophizing and somatization shows consistency in the way TMD is considered and evaluated and its possible relationship with psychological measures.



**Figure 4.** Number of articles that addressed each of the psychological concepts found in the selected literature reviews.

## Discussion

This article aimed to identify psychological concepts and their applications on dental interventions for TMD clinical cases, based on an analysis of literature review articles. Some psychology and dentistry researching features were observed, as well as the understanding the relationship between psychological factors and physical symptoms of TMD.

TMD has been understood as a condition produced by multiple psychological or physical factors (De La Torre Canales et al., 2018; Dworkin et al., 1990; Maia et al., 2021; List & Jensen, 2017; Oral et al., 2009; Slade et al., 2007). Based on the present analysis, it was possible to identify the use of psychological concepts as outcome measures for dental interventions in cases of TMD. Furthermore, some studies were found that use interventions based on psychological approaches (e.g., cognitive behavioral therapy) as a possibility for the treatment of disorder symptoms. Nevertheless, in the set of information presented, the relationships between psychological factors and symptoms and the efficiency of these interventions are still unclear and non-systematic.

Slade et al. (2007) show that the role of psychological aspects in TMD is not clear, possibly because of the different criteria related to the diagnosis of disorder and the different ways in which psychological concepts are defined or applied (see also Orlando et al., 2007). For List and Jensen (2017), it is evident that many biological and psychological risk factors are identified in the understanding of TMD. However, the etiology remains complex and

poorly understood; for the authors, future studies need to adopt more rigorous multidisciplinary approaches to understand a treatment that is efficient in its multimodal characteristics. It seems necessary, not only to find correlations, but to understand how psychological and biological factors interact.

Although there is a variety of psychological concepts used in the studies, it was not possible to find a clear and common definition for these concepts in all the analyzed reviews (presented in Figure 4). Furthermore, it is not possible to establish clear and expressive differences between the results presented by the reviews (Table 1). Positive results on subjective measures were restricted to psychological intervention groups (e.g., cognitive behavioral therapy), while for physical measures the results were clearer for the control group, which proposed usual dental interventions (Roldan-Barraza et al., 2014; Kotiranta et al., 2014; Randhawa et al., 2016).

Another analysis to be considered involves the characteristic of measuring such results. As shown in Figure 3, the number of biological variables considered in the reviewed studies is higher when compared to the number of psychological variables. Then, we could question, given the methodology used to analyze the psychological interventions results (positive or not), whether the relationship between psychological variables and dental variables is being approached in a methodologically correct way. Apparently, both psychological and biological variables are in the role of dependent variables in the studies, while comparing the effects of sets of treatments that involve or not interventions considered as “psychological”. However, only 16.1% measures focused on psychological variables. It is possible to suppose that psychological issues still play a secondary role in TMD cases. In the case of Liu et al. (2012), no psychological measures were analyzed by the reviewed studies. About this, Aggarwal et al. (2011) highlighted the low effectiveness of psychosocial interventions in the treatment of TMD. The authors point to weak evidence of benefits from using these approaches in treatment; for instance, Cognitive Behavior Therapy (CBT), the psychological intervention most used in studies, presents results considered controversial (Aggarwal et al., 2011). In this case, new forms of investigation can be considered to seek, not the effect of interventions — on biological and psychological variables — but the reformulation of the very understanding of TMD etiology and how psychological factors are or are not determinants in the development of the disorder.

It is known that psychological variables can affect the individual at a physiological level. Studies in the area of TMD have used rats to demonstrate the possible physiological consequences of the introduction of stressful conditions for the onset of TMD (Wu et al., 2013; Wu et al., 2011; Lvet al., 2011). Gameiro et al. (2006) argue that the participation of stress in the etiology of TMD may be related to several physiological characteristics of a stressed population (e.g., change in sensory perception of pain), especially considering the incidence rates of stress, anxiety and depression in diagnosed populations. Therefore, it is relevant to consider the interaction between biological and psychological processes in an individual health states (Straub, 2014; Taylor, 2006), however, with caution to demonstrate more clearly the exact participation of these two types of variables (Gameiro, et al., 2006).

Apparently, there is a lack of clarity in literature review articles about the operational definition of the psychological concepts, suggesting a probable superficial understanding when these terms are used by non-psychological professionals. For example, of the six articles that present the concept of depression as a psychological variable related to TMD, the studies do not describe how it is defined, or even what would be its role in TMD, whether as a cause, comorbidity or consequence (Türp et al., 2007; Orlando et al., 2007; Kotiranta et al., 2014; Liu et al., 2012; Roldán-Barraza et al., 2014; Randhawa et al., 2016). No review

conducts a discussion or a deeper analysis of the meaning of this variable or another psychological variable. Although there is a long history of cooperation between multiple areas (e.g., nursing, psychiatry, dentistry, etc.) and psychology, based on the observed data, the superficiality of using concepts or practices, without the necessary foundation, stands out. It can be inferred that in most of the existing articles on this interface there is no explicit indication of the psychological-theoretical-scientific link that supports the practice of research in dentistry. It is observed in the literature a naive scientific utilitarianism, in which the psychological variables are exactly what the instruments indicate, or even what common sense suggests.

As mentioned earlier in this article, studies treat psychological variables to a large extent as a by-product or a secondary variable to TMD analysis. This finding can be considered even when observing the percentage of psychological measures compared to biological measures. Skinner (1968) argues for the need to develop clear and operational definitions in order to understand the real functional relationships in which internal events (emotional states) participate.

A last factor to be considered is the high rate of article repetitions among the analyzed reviews. In this regard, one would expect a homogeneous systematic in the results presented by the interventions. However, what is observed is a divergence between the results and the analysis. This, in turn, may be due to the low systematization of the analysis methods used by the reviews, or also due to the low systematization and lack of clear definitions of the approached concepts (Slade et al., 2007; Orlando et al., 2007, Aggarwal et al., 2011; Maydana, et al., 2010) as we have discussed in this article.

## Final considerations<sup>6</sup>

Given the data analyses produced by this study, it is possible to see that there is a lack of clarity in understanding the relationship between factors considered as psychological and symptoms present in temporomandibular disorders (Orlando et al., 2007; Aggarwal et al., 2011). The results found by the seven reviews analyzed in this article do not clearly demonstrate the effectiveness of procedures for physical symptoms when psychological interventions were used (Liu et al., 2012; Türp et al., 2007; Roldán-Barraza et al., 2014). Moreover, the apparent prevalence of research methodologies through quantitative methods/instruments seems to be a possible limit for understanding the interaction between psychological factors and TMD symptoms. New forms of investigation, using qualitative methods and case studies, can provide a new perspective to understand this interaction. On the other hand, more literature review studies, as well as studies that manage to isolate specific variables of each treatment (Aggarwal et al., 2011) could produce new knowledge that would bring greater clarity to the relationships between psychological factors and TMD symptoms.

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<sup>6</sup> Due to the data analysis process, article construction and editorial process, the data presented are delayed in relation to the production of literature. The authors consider it necessary to update the data presented here, including the years 2017-2020. On the other hand, the authors consider that the analysis carried out in the period 2000-2017 is sufficient to clearly demonstrate how the so-called "psychological factors" and "temporomandibular disorder" are related. Future studies can complement the sample of studies analyzed and investigate whether the same patterns found by us remained or were changed.

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