






Quality analysis of current research on temporomandibular disorders in professional athletes

Análise da qualidade da pesquisa atual sobre distúrbios temporomandibulares em atletas profissionais

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ABSTRACT

Objective: To carry out a systematic review to verify the latest scientific findings related to temporomandibular disorders in professional athletes. **Methods:** For the studies' selection, PubMed, SPORTDiscus, Lilacs, ScienceDirect Journals (Elsevier), Web of Science, and Scopus databases were used. The full texts of the qualified publications were read and selected for the final decision, meeting the inclusion criteria, after discussion between two reviewers. Newcastle-Ottawa Quality Assessment Scale was used for qualitative analysis of the studies. The risk of bias was also assessed in seven categories: selection bias, study design, confounding factors, blinding, data collection methods, integrity, and intervention analysis. Data analysis was performed by two examiners independently. **Results:** The review included 6 independent studies. Most of the articles suffer from uncertainties regarding the selection of the sample and blinding of the evaluations and analyzes. Only two of the studies carried out an outline to control possible confounding factors. **Conclusion:** Studies on temporomandibular disorders help in the identification and clarification of risk factors that may be prevalent for these subjects, as well as contributing to the development of control and treatment strategies in the case of the presence of these diseases. However, research in this area, especially considering the patient athlete, is incipient, indicating the need for further investigation on the subject.

Keywords: oral health; temporomandibular joint dysfunction syndrome; temporomandibular joint; sports medicine; dentistry.

RESUMO

Objetivo: Realizar uma revisão sistemática para verificar os últimos achados científicos relacionados à desordem temporomandibular em atletas profissionais. **Métodos:** Para a seleção de estudos, foram utilizados os bancos de dados PubMed, SPORTDiscus, Lilacs, ScienceDirect Journals (Elsevier), Web of Science e Scopus. Os textos completos das publicações qualificadas foram lidos e selecionados para decisão final, atendendo aos critérios de inclusão, após discussão entre dois revisores. Foi utilizada a Newcastle Ottawa Quality Assessment Scale para análise qualitativa dos estudos. O risco de viés também foi avaliado em sete categorias: viés de seleção, desenho do estudo, fatores de confusão, cegamento, métodos de coleta de dados, integridade e análise da intervenção. A análise dos dados foi realizada por dois examinadores de forma independente. **Resultados:** A revisão incluiu 6 estudos independentes. A maior parte dos artigos sofre de incertezas quanto a seleção da amostra e cegamento das avaliações e das análises. Apenas dois dos estudos realizam um delineamento com o objetivo de controlar possíveis fatores de confusão. **Conclusão:** Os estudos sobre a desordem temporomandibular auxiliam na identificação e no esclarecimento dos fatores de risco que podem ser preponderantes para estes sujeitos, assim como contribuem para a elaboração de estratégias de controle e tratamento no caso da presença destas doenças. Entretanto, as pesquisas nesta área, especialmente considerando o paciente atleta, são incipientes, indicando a necessidade de uma investigação mais aprofundada sobre o tema.

Palavras-chave: saúde bucal; síndrome da disfunção da articulação temporomandibular; articulação temporomandibular; medicina esportiva; odontologia.

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Introduction

Amateur and professional athletes seek to improve their competitive results routinely by recruiting physiological stimuli. Many of these mechanisms, at some point, can cause non-functional disorders. The American Academy of Orofacial Pain (AAOP) defines temporomandibular disorders (TMD) as changes that involve different problems associated with the muscles of the masticatory system, the temporomandibular joint (TMJ) and other adjacent structures, in the presence of painful symptoms, joint noise, and restriction of movements [1,2]. The etiology of TMD is multifactorial and covers different factors among individuals, being responsible for the appearance of signs and symptoms related to the stomatognathic system, compromising the functions related to the structures involved [3,4].

According to the range of functions of the structures that may be compromised during the existence of TMD, we can observe the presence of clinical problems, including muscle pain, joint pain, and TMJ degeneration, displacement of the articular disk, difficulty in chewing, swallowing and in speech, reduced range of motion and mandibular deviation during TMJ function [3,4]. Besides, TMDs can negatively influence the individual's mental health, affecting school performance, work, and social activities, plus contributing to the appearance of affective and cognitive problems [5,6].

TMDs, as they eventually present very important symptomology, can limit the willingness of individuals to perform sports, which, in a way, can increase their consequences, as regular physical activity helps to control pain and other symptoms, and may even reduce treatment costs for chronic conditions [7]. The practice of regular physical activity or physical exercise is a relatively accessible, safe, and low-cost activity, which can bring numerous important improvements to the lives of practitioners, improving general muscle conditioning, body composition and positively affecting the health of the subjects [8,9].

Studies that evaluate the athlete's routine or the performance of their activities in competitions and the conditions that involve oral health are increasingly in evidence. The research seeks to understand how these conditions can be related and what impacts the athlete's development. Oral diseases such as TMD can have consequences that modify some aspects of individuals' physical and mental well-being and can, therefore, be a potentially significant factor when we think about developing sports performance [5]. Besides, the limitation of functional activities ends up potentiating forms of psychological suffering such as anxiety, stress, and depression, causing social impairment, reduced work capacity, physical disability, and increased social costs [10,11].

Understanding the health conditions and oral and orofacial diseases is very important for professionals who work with athletes since the disorders that affect this region can harm people's lives, as well as limit the practice of sport and the encouragement to perform physical activities, which can be even more crucial when we

think about the professional athlete. Thus, considering the importance of high-performance sports, the objective of the study was to conduct a systematic review of the literature, to verify the quality of the studies that investigate TMDs in professional athletes.

Methods

This systematic review was registered in PROSPERO under the code CRD42020164929 and was conducted according to the guidelines described in Preferred Reporting Items for Systematic Reviews and Meta-analyses - PRISMA statement [12].

Search strategy

For the studies' selection, the databases PubMed, SPORTDiscus, Lilacs, ScienceDirect Journals (Elsevier), Web of Science, and Scopus were used. As the surveys were carried out during May 2019, the works published up to the search time were included. The selection of studies was performed using the following combination of descriptors: ("Temporomandibular Joint Syndrome" OR "Temporomandibular Dysfunction*" OR "Temporomandibular syndrome*" OR "TMJ Syndrome" OR "TMJ Dysfunction*" OR "TMJ Disorder*" OR "temporomandibular disorder") AND ("athlete*" OR "sport*"). All research was limited to studies in humans.

Eligibility and data extraction

All selected references were managed in the EndNote X7 bibliographic software. Subsequently, all duplicate references were deleted. The inclusion criteria were as follows: 1) observational studies, 2) studies that analyzed TMD in professional athletes, using any evaluation method, and 3) complete studies published in English. Two independent reviewers (CRS and TLB) selected the references retrieved through the titles and abstracts of the publications, to test them according to the eligibility criteria for inclusion in the review. The full texts of the qualified publications were read and selected for a final decision, meeting the inclusion criteria, after discussion between the two reviewers. The resulting references were managed in an Excel file (Excel® - Microsoft Corporation, Redmond, Washington), listing their year of publication, the author's first name, title, journal, and reason for exclusion. There was no restriction on the year of publication. The search started identified 212 articles. After removing duplicate papers, the titles and abstracts of the resulting 130 studies were evaluated. 26 eligible papers were read in full and assessed for selection criteria. 20 articles were excluded because they did not address the proposed theme of this review. After selection for review, the following data were extracted from each article; author, sample characteristics, sport practiced, objectives, type of study, main results, and value of the Newcastle-Ottawa Quality Assessment Scale (NOS).

Quality assessment and risk of bias

The reviewers independently assessed the risk of bias in the included studies, using the Newcastle-Ottawa Quality Assessment Scale (NOS). The NOS assigned a score ranging from zero to nine stars for each article, in which a larger number of stars indicates a higher quality study. Moreover, the risk of bias was also assessed in seven categories: selection bias, study design, confounding factors, blinding, data collection methods, integrity, and intervention analysis. Each section was judged on low risk, moderate risk, or high risk, based on the study's description. The NOS scale and its usage guidelines are available in full at http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp.

Data analysis

CRS and TLB independently evaluated each study, considering seven items of risk of bias (selection bias, study design, confounding factors, blinding, data collection methods, integrity, and analysis of the intervention). Disputes were resolved through a third reviewer (BCS). The critical analysis also considered the approach adequacy, using criteria with the sample selection method, blinding, control of variables, target population, the analysis performed, according to the type of study and the NOS scale

Results

Description of selected studies

The search in the databases initially identified 212 articles, of which 82 were excluded because they were duplicates and 104 were excluded after reviewing the title and abstract (figure 1). Of the 26 resulting studies, 20 studies were excluded in the last stage of the selection evaluations because they did not correspond to the proposed theme or use another type of sample. Thus, the systematic review included 6 independent studies. The characteristics of the included studies are summarized in Table I. Among these studies, three were carried out in Brazil, one in Spain, one in Turkey, and one in Australia. According to the study design, three were cross-sectional observational studies, a case-control study, a case report, and the other was a series of cases. Among the sports evaluated, we find cycling, basketball, boxing, handball, karate, and Mixed Martial Arts (MMA). Regarding the quality of the study, the NOS score ranged from 1 to 9 (figure 2).

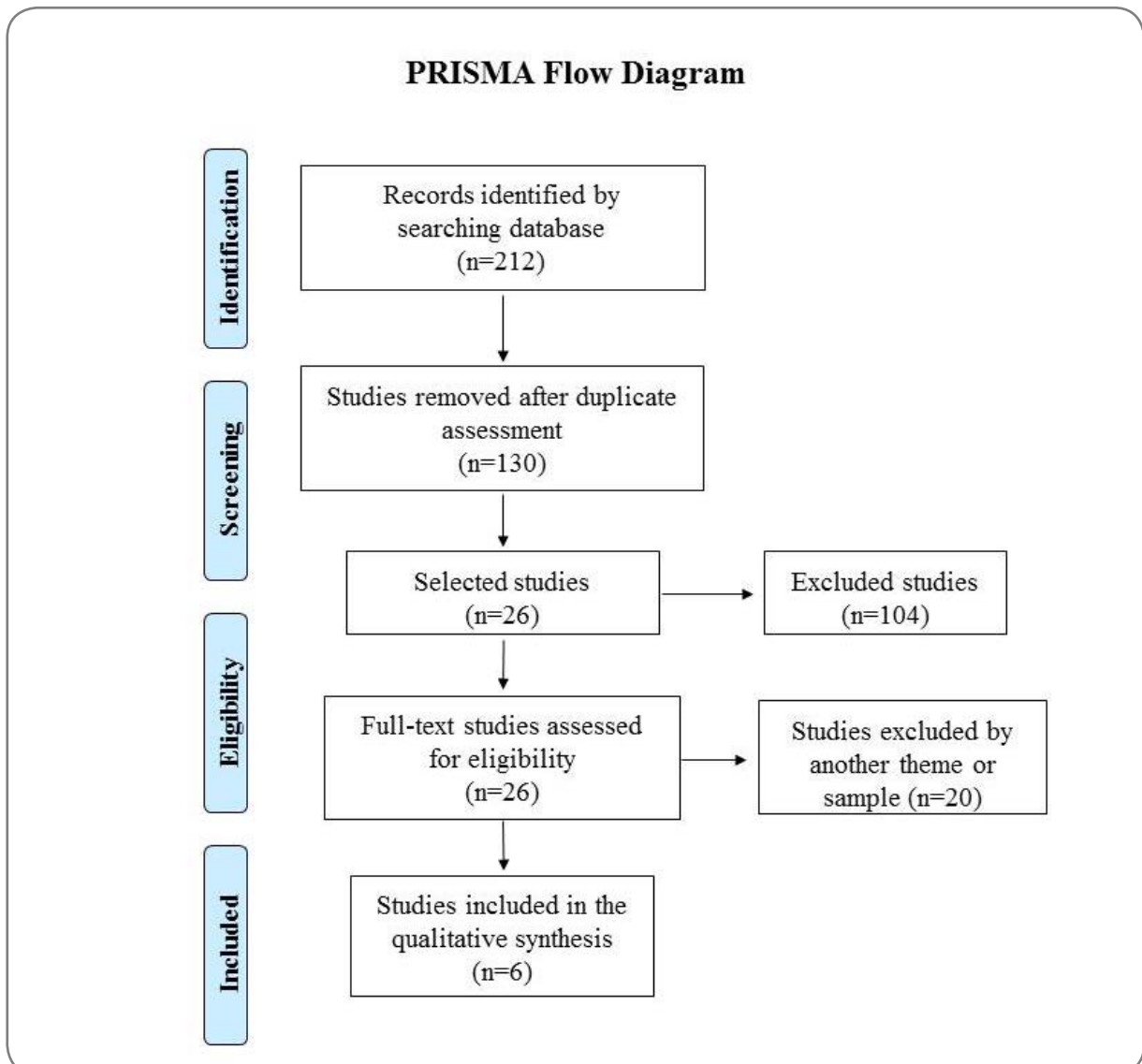


Figure 1 - Flow diagram of research and selection of literature, according to the PRISMA statement

	Selection Bias	Type of study	Control of confounding variables	Blinding	Data collection methods	Integrity of the intervention	Data analysis	Risk of Bias
Mason, 1992 [13]	●	●	●	●	●	●	●	High
Muhtarogullari et al., 2004 [14]	●	●	●	●	●	●	●	Moderate
Weiler et al., 2010 [15]	●	●	●	●	●	Not applicable	●	Moderate
Weiler et al., 2013 [16]	●	●	●	●	●	Not applicable	●	Moderate
Mendoza-Puente et al., 2014 [17]	●	●	●	●	●	Not applicable	●	Low
Bonotto et al., 2015 [18]	●	●	●	●	●	Not applicable	●	Low

● Acceptable
 ● Uncertain
 ● Not acceptable

Figure 2 - Assessment of the studies' methodological quality

Chart I. Basic characteristics of the included studies

Authors	Sample	Sport	Objectives	Study type	Main results	NOS
Mason, 1992. [13]	16-year-old athlete	Cycling	To report a treatment performed.	Case report	The patient underwent an occlusal adjustment intervention, following his occlusion pattern. After treatment, there was a reduction in the symptoms presented.	1
Muhtarogullari et al., 2004. [14]	18 basketball players, aged 14 to 32 years old	Basketball	To present the cases of 18 basketball players who had TMJ problems, with a history of sports injuries related to the head or jaw region.	A series of cases	TMD patients also had periodontal problems, probably due to inadequate oral hygiene due to limited mouth opening and joint pain. The patients underwent different interventions, such as the use of myorelaxative plaque, drug treatment, and physiotherapy. There was a significant reduction in symptoms in all cases.	7
Weiler et al., 2010. [15]	46 basketball players, aged 10 to 13 years old and 41 non-athlete teenagers aged 10 to 18 years old	Basketball	To compare the prevalence of TMD signs and symptoms in adolescent athletes and non-athletes and examine the association with different Tanner maturation stages.	Cross-sectional study	There was no significant difference between the prevalence of TMD symptoms in athletes and non-athletes. Also, no relationship was found between these symptoms and Tanner's maturation stages.	6
Weiler et al., 2013. [16]	89 basketball and handball players, aged 10 to 18 years old and 72 non-athlete teenagers	Basketball and handball	To compare the prevalence of TMD signs and symptoms in adolescent athletes and non-athletes and examine the association with different Tanner maturation stages.	Cross-sectional study	There was no significant difference between the prevalence of TMD symptoms in athletes and non-athletes. Also, no relationship was found between these symptoms and Tanner's maturation stages.	6
Mendoza-Puente et al., 2014. [17]	18 boxers as a case group and 20 handball players as a comparison group	Boxe and handebol	To evaluate the differences in the incidence of headache, mechanosensitivity of the trigeminal nerve, and temporomandibular functionality in boxers compared to handball athletes.	Case-control	Os boxeadores mostraram leve comprometimento da função mandibular, sensibilização muscular e neural local e maior impacto de dores de cabeça do que os jogadores de handebol.	9
Bonotto et al., 2015. [18]	24 atletas de karatê, 24 praticantes amadores de karatê, 17 lutadores MMA e 28 não atletas	Karatê e MMA	Investigar a prevalência de DTM em lutadores de artes marciais de alto desempenho e compará-la com a prevalência em atletas recreativos e não atletas.	Cross-sectional study	A dor crônica associada à DTM foi de baixa intensidade e de baixa incapacidade. Embora tenha havido maior prevalência de DTM nos atletas profissionais, esta condição em atletas recreativos foi semelhante à de indivíduos que não praticavam artes marciais.	9

NOS = Newcastle-Ottawa Quality Assessment Scale. TMJ = Temporomandibular joint. TMD = Temporomandibular disorders. MMA = Mixed Martial Arts

Discussion

It was possible to verify that a small number of studies were selected to compose this review, possibly due to the lack of work on this topic, for this population in particular, and because sports dentistry is a relatively new specialty in most countries, compared to other dentistry specialties. No studies were identified addressing the possible causes of TMD in athletes, nor about the relationship of this disorder with other variables in the sports field, such as stress, mood, anxiety, motivation, resilience, burnout, among others. Only one study showed results on the consequences of TMD in sportspeople [17], the others investigated the prevalence of this dysfunction [15,16,18] or reported cases with clinical interventions [13,14]. This research suggests that we know little about TMD in athletes and that the moderate prevalence of this disorder in this population group should be considered to guide further studies in the area.

Considering the criteria of the qualitative analysis, it was possible to observe that the studies, in general, have significant methodological problems such as the lack of sample calculation and blinding methods during the evaluations. These criteria confer representativeness, power, and reliability of the data. Likewise, the control of confounding variables is essential when analyzing complex conditions such as TMD. The athlete patient has specific risk factors related to the modalities of the sport practiced, such as, for example, the occurrence of orofacial trauma and periods of tension and stress, which can favor the onset of this disease or crucial symptoms in the TMJ region [19,23].

Studies with a low bias risk present interesting results regarding their findings. Fight sports athletes have increased excitability in the trigeminal nerve's sensory branches and the masseter muscle, a higher report of orofacial and head pain, as well as a greater risk of TMD when compared to other sports [17,18]. Disc displacement was the most common TMD subtype among professional athletes practicing martial arts [18]. The results of the studies suggest that the pathology investigated may have a higher prevalence in these athletes, as well as having risk factors conditioned to the sport.

TMDs correspond to a group of musculoskeletal disorders that affect the masticatory muscles and/or the temporomandibular joint and have a relevant prevalence in the population, being reported that it is possible to find some pathological symptom in almost 60% of individuals [19]. The etiology of these conditions is widely studied, but still little known, considering the magnitude of its influence on the development of TMD, and reports of different influencing factors can be found, such as occlusion, parafunction, emotional stress, hormonal changes, physical trauma, microtrauma in teeth, joint hypermobility, and some dental treatments [20,21]. As it presents a significant potential for comorbidity, influencing people's habits and quality of life, the study of TMDs is relevant, since their better understanding contributes to a more accurate clinical practice [22].

There is a growing increase in studies that correlate the quality of life or the performance of individuals' routine activities and the conditions that involve oral health. These surveys seek to clarify how these conditions are related and what importance they represent in people's lives. Situations related to oral health and the stomatognathic system, such as TMD, can have consequences that modify some aspects of individuals' physical and mental well-being and, by extension, we can also suggest that these conditions may have an impact on sports activity [5]. The pains and symptoms reported are commonly located in the masticatory muscles and the preauricular region, which can be easily exacerbated by chewing and by the jaw movement activity, resulting from the body's natural physiological functions. These factors are expressive when considering a professional athlete who needs a constant physical and mental effort to carry out all their training and competitions routine [11].

As TMD can also involve other conditioning factors such as psychological conditions, anxiety, tension, pain, and even disorders related to changes in the spine, [24] it is necessary to understand its causes and consequences in sports, as well as its interference in the physical and emotional activities of the athletes, who are subject to numerous situations during sports activities, involving training and competitions. The results of this review showed us that little is known about the mechanisms of TMD development in athletes and much can be studied and discussed to understand the role of this pathology on the sports patient.

Limitations and recommendations for further studies

Among the detected limitations, the selection and dimensioning of the samples, the criteria for blinding the evaluators, and the control of confounding variables are highlighted. Most studies have a small and convenient sample, composed of selected volunteers, which reduces the representativeness of the information obtained. The sample size calculation must be performed to improve the quantitative analyzes of the studies. Furthermore, researches could be carried out with athletes from different sports to check if there is any difference between the risk factors for the development of TMD and relevant data on the prevalence of this situation, according to the sport practiced. Another possible evaluation method could consider the training experience, comparing the occurrence of changes in the TMJ of amateur and professional athletes. As it is a condition that can comprise different risk factors, a multivariate analysis could be considered to identify a cut-off point on the number of exposure factors necessary to cause significant damage to the development of routine activities of a patient athlete.

Conclusion

Research on the proposed topic is still very incipient, indicating the need for more accurate research on the subject. The athlete's evolution within the sport modality, as to his performance, depends on the physical preparation and the harmony

of physical, psychological, and biological factors. Thus, studies on TMD in athletes can help to identify and clarify risk factors for sports performance.

Potential conflict of interest

No conflicts of interest with potential for this article have been reported.

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Non-applicable.

Academic linkage

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Authors' contribution

Conception and design of the research: Springer CR, Boletini TL, Noce F. **Data collection:** Springer CR, Boletini TL. **Analysis and interpretation of data:** Springer CR, Souza BC. **Writing of the manuscript:** Springer CR, Souza BC. **Critical review of the manuscript for important intellectual content:** Lopes AL, Melo CC, Noce F.

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