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Review Article

Is there relationship between temporomandibular disorders and head and cervical posture? A systematic review

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SUMMARY **The objective of this systematic review was to find sufficient evidence to deny or accept the association between the head and cervical posture and temporomandibular disorders (TMDs), and thus assist health professionals in the evaluation and treatment of patients with TMDs. A search was conducted through all publications written in English about this topic using the databases from Medline, ISI Web of Science, EMBASE, PubMed and Lilacs. The abstracts that fulfilled the initial guideline were retrieved and evaluated to ensure they met the inclusion criteria. To assess the methodological quality of the studies, we developed a questionnaire considering the following criteria: participant's eligibility, control group, diagnosis of TMDs, posture diagnosis and randomisation. Twenty-two studies were selected as potential studies based on their abstracts. Only seventeen studies actually fulfilled the inclusion criteria. The search provided information about the methodological quality of the studies, in which several methodological defects were found. The evidence presented in this systematic review shows that the relation between TMDs and the head and neck posture is still controversial and unclear. The insufficient number of articles considered of excellent methodological quality is a factor that hinders the acceptance or denial of this association.**

KEYWORDS: **temporomandibular joint disorders, craniofacial disorders, facial pain, cervical vertebrae, neck and posture**

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Introduction

The temporomandibular joint (TMJ) is one of the most complex and used joints in the human body, developing important functions such as chewing and speaking (1–3). The articular surfaces are covered by avascular and non-innervated fibrocartilage, which has a high regenerative capacity. The temporalis and masseter muscles control the joint's motion (3).

Temporomandibular disorders (TMDs) are a heterogeneous group of pathologies affecting the muscles involved in mastication, the TMJ or both. The most common signs and symptoms are the following: pain localised in the pre-auricular and/or chewing muscles' area, joint sounds (clicks or crepitus) and limitations or deviation upon mandibular opening (4–6).

Temporomandibular disorder is a multifactorial disease, and among its different aetiological factors, mainly five of them have been related to it: occlusion, trauma, deep pain stimulus, parafunctional activities and psychological factors, such as anxiety, depression and stress (7, 8).

In addition, several authors have reported that postural problems involving the head and cervical spine can also cause TMDs (9–11) (as the stomatognathic system and cervical spine can be considered as one) because the TMJ has muscular and ligamentous connections with the cervical region, constituting a functional compound (12), where the movements of the atlanto-occipital joint and cervical vertebrae occur simultaneously with the activation of the masticatory muscles and jaw movements (3).

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This association between craniocervical posture and TMDs has been researched but, despite the large number of studies, there is still doubt among clinicians and researchers. Some studies show that individuals with TMDs present changes in the posture of the head and cervical spine (13, 14); however, other studies find no such link (11, 15). Thus, it is necessary to carry out a systematic review on the subject to find sufficient evidence to deny or accept this association, hence assisting health professionals in the evaluation and treatment of patients with TMDs.

Materials and methods

Search strategy

A computerised database search was performed to identify relevant articles that examined the association between head and cervical spine posture and TMDs (joint pain/arthralgia, muscular pain/limitation or both). We conducted a search through Medline (1966 through January 08, 2013), ISI Web of Science (1965 through January 08, 2013), Embase (1988 through January 08, 2013), PubMed (1966 through January 08, 2013) and Lilacs (1982 through January 08, 2013). The keywords used in the search were as follows: temporomandibular joint disorders, craniofacial disorders, facial pain, cervical vertebrae, neck and posture. Only articles written in English language were selected. For details regarding the specific search terms and combinations, see Table 1.

Criteria implemented to consider studies for this review

Types of studies. The articles that studied individuals with TMD diagnosis (joint pain/arthralgia, muscular pain/limitation or both) and evaluated the association between head and cervical spine posture and TMDs were eligible for this study. Studies with children and participants with a case history of TMJ surgery, trauma or fracture in the craniomandibular system, and/or other serious comorbid conditions (e.g. cancer, rheumatic disease, neurological problems) were excluded, as well as case studies and literary reviews.

Table 1. Search results from different databases

Database	Keywords	Results	Selected	Included
PubMed	1. Temporomandibular joint disorders 2. Craniomandibular disorders 3. Facial pain 4. 1 OR 2 OR 3 5. Cervical vertebrae 6. Neck 7. 4 AND 5 OR 6 8. Posture 9. 4 AND 7 AND 8 (limits: 'Human' and 'English language')	79	17	12
Embase	1. Temporomandibular joint disorders 2. Craniomandibular disorders 3. Facial pain 4. 1 AND 2 AND 3 (limits: 'Human' and 'English language')	57	0	0
Medline	[(Craniomandibular disorders) or 'temporomandibular joint disorders'] or 'facial pain' [subject descriptor] and (cervical vertebrae) or 'neck'[subject descriptor] and posture [subject descriptor]	37	13	09
Lilacs	1. Temporomandibular joint disorders 2. Posture 3. 1 AND 2	27	6	6
Web of Science	1. Temporomandibular joint disorders 2. Cervical vertebrae 3. Posture 4. 1 AND 2 AND 3	03	03	2
Total		203	39	29
Repeated articles			17	12
Final			22	17

Data extraction

Two reviewers selected and reviewed the articles. First, each one independently selected the articles from their abstracts, and when considered potentially useful, copies of the articles were obtained and analysed in accordance with the inclusion criteria. The kappa test was applied to verify the agreement between the authors. When discrepancies between reviewers appeared with regard to whether a paper met one criterion or not, the rating forms were compared and the criterion discussed until a consensus was reached.

Quality assessment

The authors developed a questionnaire to assess the methodological quality of studies, considering the following criteria: randomisation, examiners' blinding, eligibility criteria, control group, information about the methodology used to measure the head and cervical posture, and information about the methodology used to evaluate TMDs. For each positive response, the study received one point, so at the end, the studies were rated as weak (1–2), moderate (3–4) or strong (5–6; Table 2).

The critical appraisal was independently completed by the two reviewers, and their results were compared afterwards. Any discrepancies were settled through discussion.

Results

The literary search in the different databases resulted in a total of 203 articles. From these 203 articles, 22 were selected as potential studies based on their abstracts ($K = 0{\cdot}89$ $P < 0{\cdot}001$). Only 17 studies actually fulfilled the initial criteria. The result of the kappa test to select articles after applying the inclusion/exclusion criteria was $K = 1{\cdot}0$ ($P < 0{\cdot}001$); therefore, 100% agreement was obtained between the two researchers. Five studies were rejected after applying the inclusion/exclusion criteria. The reasons for exclusion included non-experimental studies: literary reviews (30–32), letters to the editor (33) and studies with children (14).

Methodological quality of included studies

The agreement between the two reviewers was perfect: $K = 1{\cdot}0$ ($P < 0{\cdot}001$). The characteristics of the studies analysed by this review were:

1 Use of a randomised sample in the selection process: 6 (11, 18, 22, 24, 25, 29) of 17 studies;
2 Examiners' blinding: 10 (11, 13, 15–18, 20, 24, 25, 29) of 17 studies;
3 Proper report about the eligibility criteria: 12 (11, 13, 16–20, 22, 24–26, 29) of 17 studies;
4 Use of a control group: 15 (11, 15–24, 26–29) of 17 studies;
5 Proper report about the methodology used to measure the head and cervical posture: 13 (9, 11, 15, 17–24, 26, 28) of 17 studies;
6 Proper report about the methodology used to diagnose TMDs: 14 (11, 15–27) of 16 studies.

The results of the critical appraisal are presented in Table 2.

Study's results/methodological quality of included studies

Seventeen studies were evaluated and 70·58% (11, 13, 17, 19–25, 27, 28) presented connections between TMDs and the head and neck posture, from which five were classified as strong, four as moderate and three as weak. A total of 29·42% (15, 16, 18, 26, 29) of the studies did not find connections between TMDs and the head and neck posture, from which two were classified as strong and three as moderate (Table 3).

Discussion

Nowadays, the easy access to scientifically conducted studies enables the dissemination of knowledge and brings benefits to the scientific and medical community; however, it is necessary to analyse carefully their quality, to avoid erroneous conclusions from their results. This discussion approached selected studies that verified the association between head and cervical posture and TMDs, presenting the real applicability to the clinical practice.

Among the seventeen articles selected in this review, seven (11, 16–18, 22, 24, 25) were classified as strong, according to our evaluation criteria; only 2 (16, 18) concluded that the posture of Individuals with TMDs does not differ from the posture of people without TMDs. Therefore, the presence of TMDs does not influence the head and cervical spine posture. Iunes *et al.* (18) rated with a 6, so their results can be considered reliable because of the high methodological quality presented. The results showed by Armijo-

Table 2. Methodological rating of included studies

	Randomisation		Blinding of examiner		Eligibility criteria		Control group?		Information about the methodology used to measure the head and cervicalposture		Information about the methodology used for the evaluation of temporomandibular disorders (TMDs)		
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Rating
Armijo-Olivo *et al.* (16)		0	1		1	7	1		1		1		5
De Farias Neto *et al.* (17)		0	1		1		1		1		1		5
Iunes *et al.* (18)	1		1		1		1		1		1		6
Matheus *et al.* (15)		0	1			0	1		1		1		4
Saito *et al.* (19)		0		0	1		1		1		1		4
Strini *et al.* (20)		0	1		1			0	1		1		4
Ferrão *et al.* (21)		0		0		0		0	1		1		2
Munhoz *et al.* (22)	1			0	1		1		1		1		5
Evcik & Aksoy (23)		0		0		0	1		1		1		3
Munhoz *et al.* (24)	1		1		1		1		1		1		6
Visscher *et al.* (11)	1		1		1		1		1		1		6
Nicolakis *et al.* (13)		0	1		1		1			0		0	3
Wright *et al.* (25)	1		1		1		1			0	1		5
Hackney *et al.* (26)		0		0	1		1		1		1		4
Huggare *et al.* (27)		0		0		0	1			0	1		2
Shiau *et al.* (28)		0		0		0	1		1			0	2
Darlow *et al.* (29)	1		1		1		1			0		0	4

Table 3. Presentation of study's results and scores received according to our evaluation

	Rating	Association between craniocervical posture and temporomandibular disorders (TMDs)
Iunes *et al.* (18)	6	Negative
Munhoz *et al.* (24)	6	Positive
Visscher *et al.* (11)	6	Positive
Armijo-Olivo *et al.* (16)	5	Negative
De Farias Neto *et al.* (17)	5	Positive
Munhoz *et al.* (22)	5	Positive
Wright *et al.* (25)	5	Positive
Matheus *et al.* (15)	4	Negative
Saito *et al.* (19)	4	Positive
Strini *et al.* (20)	4	Positive
Hackney *et al.* (26)	4	Negative
Darlow *et al.* (29)	4	Negative
Evcik & Aksoy (23)	3	Positive
Nicolakis *et al.* (13)	3	Positive
Ferrão *et al.* (21)	2	Positive
Huggare *et al.*(27)	2	Positive
Shiau *et al.*(28)	2	Positive

Olivo *et al.* (16) and Wright *et al.* (25) are also considered reliable, despite the fact that Armijo-Olivo *et al.* (16) did not use a random sample and that assessment criteria for the head and neck posture were not clearly specified by Wright *et al.* (25). Other five studies (11, 17, 20, 22, 24) that were considered strong found association between TMDs and the head and neck posture, although just Visscher *et al.* (11) and Munhoz *et al.* (24) did not present methodological failures according to our assessments. As for the study performed by Munhoz *et al.* (22), the examiners were not blinded, potentially increasing the risk of bias and compromising the reliability of the results. de Farias Neto *et al.* (17) found that individuals with TMDs have a tendency to present hyperlordosis of the cervical spine, but the authors pointed out that their results should be carefully examined taking into account the small sample size. They also questioned whether the static postural assessment of the cervical spine used by them is the most appropriate to study the relationship between TMDs and the cervical spine, once the temporomandibular joint is a dynamic component. Wright *et al.* (25) made their results less reliable because they do not describe clearly the methods used to evaluate the head and neck posture.

Among the seven studies (13, 15, 19–21, 23, 26) classified as moderate, four (13, 19, 20, 23) presented association between TMDs and the head and neck posture; however, among six items analysed through a questionnaire developed to assess the methodological quality, at least two flaws appeared in those studies, making them less reliable. Saito *et al.* (19) did not use a random sample, did not describe the methodology used for the diagnosis and did not reported whether the evaluators were calibrated for the examinations. However, they carefully described how the patients' disorders were clinically diagnosed by graduate students and how those diagnoses were confirmed by specialists later on. Nicolakis *et al.* (13) and Strini *et al.* (20) did not include a control group in their research, which restricts the search for the relationship between cause and effect. However, ethical implications must be considered as well as treatment simulations in healthy individuals, which may be questionable. Evcik and Aksoy (23) also made mistakes, weakening the validity of their results. They did not use a random sample, the examiners were not blinded and the eligibility criteria of the sample were not specified.

Matheus *et al.* (15), Hackney *et al.* (26) and Darlow *et al.* (29), whose studies were classified as moderate, did not find connection between TMDs and the head and neck posture, but the lack of randomisation of the samples and the failure in the description of the eligibility criteria in the selection stage of the samples weakened the results of those studies. Just like the failure in the description of the methods used for evaluating TMDs and the head and neck posture, the reliability of the results presented by Darlow *et al.* (29) also decreased, preventing the association between mixed TMDs and the head and neck posture, as this would require more support with the help of accurate diagnostic methods.

Three studies (21, 27, 28) classified as weak by this review presented connection between TMDs and the head and neck posture. However, the inclusion and exclusion criteria were not clearly described for the sample selection, which complicates the interpretation of results, as the characteristics of the population were not precisely defined. The sample selection in a scientific study should clearly define the criteria for inclusion and exclusion, so that the sample accurately represents the population with the desired characteristics, thus minimising factors that may compromise the final results. Additionally, none of the three studies (21, 27, 28) was a blinded study and samples were

not randomised in the selection process, potentially increasing the risk of bias and compromising the reliability of results.

According to our evaluation criteria, only seven studies (11, 16–18, 22, 24, 25) among all the selected ones presented high methodological quality, five studies (11, 17, 22, 23, 28) presented relationship between TMDs and the head and neck posture, and 2 (16, 18) presented no correlation whatsoever. On the other hand, just three studies (11, 18, 24) showed excellent methodological quality, which means that they reached the highest rating (6) in our evaluation. Therefore, 100% of the studies that presented no relationship between TMDs and the head and neck posture had good methodological quality and were classified with a strong or moderate rating, 20% of the studies that presented a relationship between TMDs and the head and neck posture had their methodological qualities considered weak, and 80% strong or moderate.

In summary, the authors did not reach a consensus on the presence of the relationship between TMDs and the head and neck posture. Some studies have supported this hypothesis and others have not. In this review, 70·58% of the studies found a relationship between TMDs and the head and neck posture, but evidences are not a matter of quantity, but quality. It was possible to find carefully prepared studies that showed the relationship between TMDs and the head and neck posture, as well as studies that did not present this relationship. Bearing in mind the complexity of aetiology and diagnostics of TMDs and its possible connection with the head and neck posture, more quality and careful studies are required.

In this review, it is necessary to take into account that there was no evaluation neither for the sample size nor for the statistical analysis used by the authors, factors that could have influenced on the evaluation results.

Conclusion

The evidence presented in this systematic review shows that the relationship between TMDs and the head and neck posture is still controversial and unclear. The insufficient number of articles considered of excellent methodological quality is a factor that hinders the acceptance or denial of this association.

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Ethical approval

Not applicable.

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Conflict of interests

There are no conflict of interests.

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