



Prevalence of temporomandibular joint disorders and neck pain in musicians: a systematic review

Prevalência de distúrbios da articulação temporomandibular e cervicalgias em músicos instrumentistas: uma revisão sistemática

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Abstract

Introduction: The instrumental practice for a long time, the high performance level, the strict technique and the specific shape of each musical instrument can take musicians to overcome their physiological limits, giving a high prevalence of musculoskeletal injuries. **Objective:** Investigate the prevalence of temporomandibular joint disorder and neck pain in musicians. **Methods:** Between August and September 2015 were reviewed five databases: LILACS, SciELO, Medline / PubMed, Scopus and Web of Science. The articles were read and evaluated by the criteria of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE), items, that obtained a percentage above of 50 percent, were considered in the analysis of this work. **Results:** 15 articles attended the inclusion criteria. Among all musicians the prevalence of TMJ pain ranged from 10 - 81% and the prevalence of neck pain ranged from 29 - 80%. **Conclusion:** In this study was observed that the musicians showed both, temporomandibular joint disorders and neck pain, watching a high prevalence especially in violinists and the horn players. In the risk factors identified in the literature for the emergence of painful symptoms in musicians, stand out the biomechanical factors involved in maintaining anti-physiologic postures.

Keywords: Temporomandibular Joint Disorders. Epidemiology. Neck Pain. Music.

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Resumo

Introdução: A prática instrumental por tempo prolongado, o alto grau de desempenho, a rigorosa técnica e o formato específico de cada instrumento musical podem levar os músicos a ultrapassarem seus limites fisiológicos, conferindo uma alta prevalência de lesões musculoesqueléticas. **Objetivo:** Investigar a prevalência de transtornos da articulação temporomandibular e de cervicalgia em músicos. **Métodos:** Entre agosto e setembro 2015 foram examinadas cinco bases de dados: LILACS, SciELO, MedLine/PubMed, Scopus e Web of Science. Os artigos foram lidos e avaliados pelos critérios do Strengthening the Reporting of Observational Studies in Epidemiology (STROBE), artigos que obtiveram um percentual acima de 50% foram considerados na análise do presente trabalho. **Resultados:** Atenderam aos critérios de inclusão nesse estudo 15 artigos. Dentre todos os músicos a prevalência de dor na ATM variou de 10 - 81% e a prevalência de cervicalgia variou de 29 - 80%. **Conclusão:** No presente estudo pôde-se verificar que os músicos apresentam tanto DTM quanto cervicalgias, observando uma alta prevalência em especial os violinistas, os violistas e os instrumentistas de sopro. Entre os fatores de risco identificados na literatura para o surgimento de sintomas dolorosos em músicos destacam-se os fatores biomecânicos envolvidos na manutenção de posturas antifisiológicas.

Palavras-chave: Transtornos da Articulação Temporomandibular. Epidemiologia. Cervicalgia. Música.

Introduction

The term temporomandibular joint disorders (TMJD) is commonly used to describe a number of signs and symptoms that generate functional and pathologic alterations involving the masticatory muscles, the temporomandibular joint (TMJ) and the whole stomatognathic system (1 - 3). Among the main symptoms involved are: joint pain, limitation or asymmetry of the movements, noises in the TMJ, the increased tension of the masticatory muscles, muscle fatigue, headaches and wear occlusal associated with parafunctions as, for example, bruxism and dental tightening (4 - 7). This functional impairment associated with TMJD can cause anxiety, common to other chronic diseases patients, leading to negative effects on their life quality (LF) (8 - 10).

Correlations are made about the existence of signs and symptoms of neck pain in TMJD patients, for postural cervical changes that alter the mandibular and condyle postures. Adding also that painful stimuli in the neck can lead to pain in the facial region. In this respect, the neck pain is multifactorial in origin and occurs frequently in the working population, especially in those who perform static postures tasks, for example, in raising the upper limbs (11, 12).

For music fans this is considered as an art and emotion expression, closely associated with the leisure and well-being, however, when evaluating the

performative activity in musical instrument, the look on the music activity exercise as profession should be differentiated by checking that the activity requires productivity and high performance with both psychological as physical capabilities (13).

In this aspect, the instrumental practice for a long time, the high level of performance required, the individual strict technique and the specific format of each musical instrument can lead professionals, often to exceeding their physiological limit (13, 14). This fact associated with poor posture, constant muscle usage and the playing tendency, even in the presence of pain, exposes this population to the psychological and physical burden of considerable intensity, leading to the occurrence of so-called Repetitive Strain Injury / Musculoskeletal Disorders related to work (RSI / MSDs) as reported in the literature, among which includes neck pain and TMJD (13 - 17).

Studies show that the prevalence of RSI / MSDs, in general, is high revealing a public health problem, in addition, these dysfunctions have increasingly earlier appeared in life professionals (16). The impact is not only in the quality of life decreasing, but also in the fact that these disorders can lead to early closure of their careers (16).

Understanding that the musician activity is a working line and as such can bring physical and psychological overload documented in the literature is that the present study aimed to investigate

the prevalence of temporomandibular disorder and neck pain in musicians, as what is noted, are general data without specific pathologies.

Methods

Five databases were carefully examined: Latin American and Caribbean Health Sciences Literature (LILACS), Scientific Electronic Library Online (SciELO), Medical Literature Analysis and Retrieval System Online (MEDLINE / PubMed), Scopus and

Science Citation Index Expanded (Web of Science). The descriptors used were obtained in Descriptors of Health Sciences (DeHS) and Medical Subject Headings (MeSH).

Thus, the keywords were used in the Boolean operators, “and” and “or”: temporomandibular joint disorders, temporomandibular joint disease, epidemiology, incidence, prevalence, music, occupational diseases, neck pain, risk factors, musicians, pain. The review was conducted in August and in September 2015 and the search strategy in each base can be seen in Table 1.

Table 1 - Search strategy in electronic databases, Brasilia, 2016

Data base	Key words	Booleans operators	Obtained references
Medline/PubMed	Temporomandibular joint disorders, temporomandibular joint disease, epidemiology, incidence, prevalence, music, occupational diseases, neck pain, risk factors, musicians e pain	And/Or	26
LILACS	Temporomandibular joint disorders, temporomandibular joint disease, epidemiology, incidence, prevalence, music, occupational diseases, neck pain, risk factors, musicians e pain	And/Or	2
SciELO Brazil	Temporomandibular joint disorders, temporomandibular joint disease, epidemiology, incidence, prevalence, music, occupational diseases, neck pain, risk factors, musicians e pain	And/Or	2
Scopus	Temporomandibular joint disorders, temporomandibular joint disease, epidemiology, incidence, prevalence, music, occupational diseases, neck pain, risk factors, musicians e pain	And/Or	27
Web of Science	Temporomandibular joint disorders, temporomandibular joint disease, epidemiology, incidence, prevalence, music, occupational diseases, neck pain, risk factors, musicians e pain	And/Or	25
Total Quotes			82

Selection Criteria: At first, the articles were selected only with the combination of descriptors, as described above. Subsequently, the abstracts of the articles were carefully read and from reading were selected those who met the following inclusion criteria: 1) articles that aimed to determine the prevalence of temporomandibular disorders and neck pain in musicians; 2) articles written in both Portuguese and English; 3) articles that were published in the last 10 years (2005 - 2015).

The flowchart of the search and selection of articles is shown in Figure 1.

STROBE score: In a third time, to check the quality of the studies found, the articles were read and evaluated by the the Strengthening the Reporting

of Observational Studies in Epidemiology criteria (STROBE) (18). Each of the 22 criteria set out by the STROBE received a score of 0 or 1 and each article would receive a final score up to 22 points. Thus, the articles were analyzed and received or not the score according to the presence of STROBE criteria.

Later on, the percentage of scores obtained on each item to better assess their quality was calculated. And so, the authors defined that the articles which obtain a percentage above 50%, in other words, those which had at least 11 of the 22 criteria would be considered good quality ones and could be part of this work analysis. In Table 2 are detailed scores of each item and its representation in percentage.

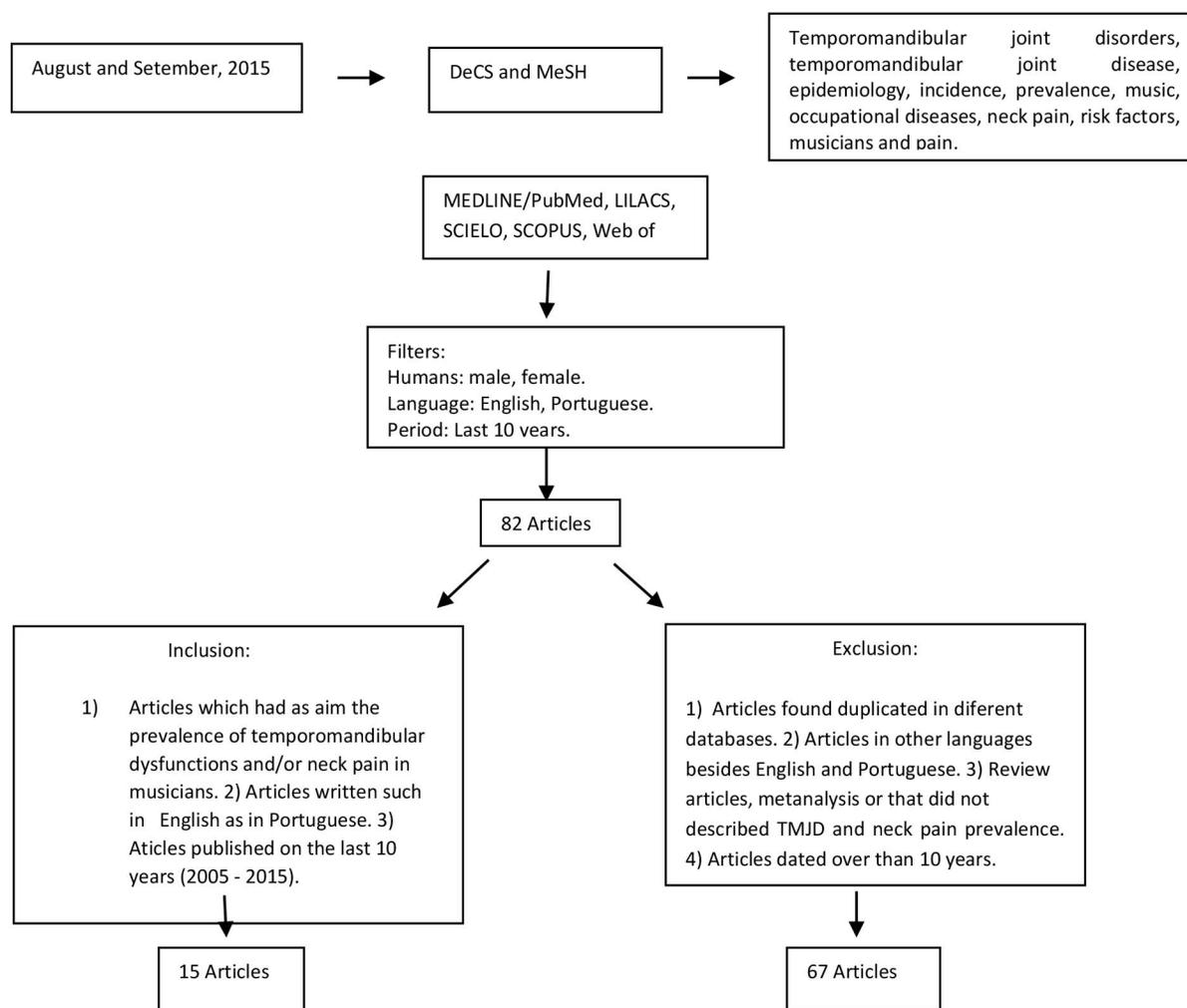


Figure 1 - Flowchart of search and selection of articles.

Table 2 - Score and quality percentage of articles from the STROBE criteria, Brasilia, 2016

Reference	Kind of study	Obtained score	%
Paarup et al, 2011 (19)	Transversal	21	95.4
Nyman et al, 2007 (12)	Transversal	19	86.3
Abréu-Ramos et al., 2007 (20)	Transversal	18	81.8
Kok et al, 2013 (21)	Transversal	18	81.8
Dhrithi et al., 2013 (22)	Transversal	18	81.8
Paarup et al, 2012 (23)	Transversal	18	81.8
Stanhope et al, 2014 (24)	Transversal	18	81.8
Steinmetz et al, 2014 (25)	Transversal	18	81.8
Neto et al., 2009(15)	Transversal	17	77.2
Rodriguez Lozano et al. 2008 (26)	Transversal	17	77.2
Pampel et al, 2014 (27)	Transversal	16	72.7
Steinmetz et al, 2009 (28)	Transversal	16	72.7
Rodriguez Lozano et al, 2010 (29)	Transversal	15	68.1
Steinmetz et al, 2006 (30)	Transversal	14	63.6
Teixeira et al, 2015 (31)	Transversal	12	54.5

Results

About 15 of the selected articles met the inclusion criteria and had enough score, according to the STROBE. Table 3 shows the main findings of each of the 15 articles analyzed.

Among the selected studies to be part of this review, four were conducted in Germany, two in Brazil, two in Spain, two in Denmark. Australia, Netherlands, Puerto Rico, India and Sweden had only one study each. The age range of the sample participants ranged from 14 to 63 years.

As for the kind of played instrument, most of the articles evaluated instrumentalists interpreters of bowed string (violin, viola and cello) and wind instrumentalists (flute, piccolo, bassoon, oboe, clarinet, trumpet, trombone and tuba). Table 4 can be seen the instrumentalists percentage found in the studies by type of instrument run.

Table 3 - Results of the described studies, Brasilia, 2016

Reference	Country	Sample	Population	Results
Abr�u-Ramos et al., 2007 (20)	Puerto Rico	82	Violin, viola, cello, contrabass, wind instrument and percussion players.	About 10% of violinists and violists related pain symptoms in the TMJ and 64% felt neck pain.
Dhrithi et al., 2013 (22)	India	66	Electric guitar players.	About 29% reported neck pain.
Kok et al., 2013 (21)	Netherlands	87	Music students.	About 34.8% reported pain in the TMJ and 73.1% in cervical.
Nyman et al., 2007 (12)	Sweden	250	Violin, viola, cello, contrabass, flute, trumpet, trombone, bassoon, clarinet, horn, oboe and tuba.	25.5% reported neck pain.
Paarup et al., 2011 (19)	Denmark	342	Violin, viola, cello, contrabass, flute, clarinet, oboe, bassoon, horn, trumpet, trombone, tuba and percussion.	80% reported neck pain.
Paarup et al., 2012 (23)	Denmark	441	Violin, viola, cello, contrabass, flute, clarinet, oboe, bassoon, horn, trumpet, trombone, tuba and percussion.	64.8% reported neck pain.
Pampel et al., 2014 (27)	Germany	102	Wind instrument players.	86.2% had joint sounds, 100% showed some parafunction.
Rodr�guez-Lozano et al., 2008 (26)	Spain	91	Violinists.	73% had bruxism.
Rodr�guez-Lozano et al., 2010 (29)	Spain	91	Violinists.	24.4% with TMJ pain, 29.3% limitation of mouth opening, 17.1% had already locking or blocking jaw, 26.8% had parafunctional habits, and 51.2% had TMJ sounds.
Stanhope et al., 2014 (24)	Australia	14	Wind instrument players.	38% reported neck pain
Stechman Neto, et al., 2009 (15)	Brazil	92	Wind instrument Interpreters (metals and reeds), violinists and violists.	42.3% have parafunction (bruxism or clenching), 25% had TMJ pain, 42% reported TMJ sounds, 40% ear fullness and 35% tinnitus.
Steinmetz et al., 2006 (30)	Germany	31	Violinists.	45% had TMJ pain, 65% pain in the masticatory muscles, 58% with TMJ noise.
Steinmetz et al., 2009 (28)	Germany	30	Violinists, pianists, cellists, clarinetists, trombonists, violists, pipers, flutists.	80% had neck pain and 63% TMJ pain.
Steinmetz et al., 2014 (25)	Germany	408	Violin, viola, cello, contrabass, flute, clarinet, oboe, bassoon, horn, trumpet, trombone, tuba, percussion and piano.	About 81% had TMJ pain, 34% had bruxism or clenching the jaw.
Teixeira et al., 2015 (31)	Brazil	11	Violists and violinists.	72.7% reported neck pain.

Table 4 - Percentage of instrumentalists by type of executed instrument, Brasilia, 2016

Instruments	%
Violin/viola	42
Cello/ Contrabass	12
Wooden ¹	26
Metals ²	12
Other ³	8

Note: 1. Flauta, piccolo, Bassoon, Oboe and Clarinet, 2 Trumpet, Trombone and Tuba, 3. Piano. Guitar, Singers, Percussion and Harp.

In the studies it was found that the prevalence of TMJ pain ranged from 10 - 81%, and in violin and viola musicians it ranged from 10 - 28%. In the wind instruments musicians the change in prevalence was of 19 - 45%.

Some studies have also evaluated the presence of parafunctional habits. In these studies it was observed that the prevalence of habits such as bruxism and teeth clenching ranged from 26.8 to 100% in all studied instrumentalists and in the wind interpreters the prevalence was of 34 - 100%. Also in violinists was found a prevalence of parafunctional habits that ranged from 34 - 73%.

Moreover, were also reported symptoms such as locking, joint noises, maximum mouth opening difficulty, ear fullness, tinnitus, masticatory muscles pain. The studies found, indicated the presence of mouth locking, indicating a symptom prevalence of 17%. The prevalence of joint sounds ranged from 42 - 58%.

Also the difficulty of maximum mouth opening with a prevalence of 29.3% was reported. The feeling of ear fullness was observed in studies with a prevalence of 40%.

The tinnitus presence was reported with a 35% prevalence. And the presence of pain in the masticatory muscles showed a 65% prevalence.

The prevalence of neck pain ranged from 29 - 80% in all studied instrumentalists and in violinists and violists it ranged from 36 - 80%. Already in wind instruments musicians ranged from 38 - 45%.

Among all the musicians surveyed the prevalence of TMJ pain ranged from 25 - 47% and the prevalence of neck pain ranged from 25 - 78%.

Regarding the gender difference, the female instrumentalists had a higher prevalence of about 50% of neck pain, males showed a prevalence of 30% in

comparison. It has been observed that women were 2.4 times more likely to report orofacial pain.

Discussion

In this study, it was observed that the musicians have both TMJD and neck pain, observing a significant prevalence, especially in violin, viola, and wind instrument (metal and wood) musicians. These findings have been substantiated in the literature by the need that the musician has to acquire the musical expertise. Thus, in order to master and refine the technique, the musician faces several hours of practice and testing, running movements repetitively and in postures, often anti-physiologic, specific to each instrument, which gives an important risk factor for the appearance of osteomyoarticular injury in general (16, 31).

When it is verified in particular in case of neck pain, identified in the present study, must be considered that this may be caused by the anti-physiologic postures mentioned in the literature, such as rotating the neck, anterior projection and head tilt and the static abduction posture with internal rotation of the right shoulder and external of the contralateral limb (14). Vicious posture as the shoulder protrusion for violin performance were also observed in previous studies. Such postures cause a trapezius distension and favors scapulohumeral pace disarrangement, which can contribute to cervical pain complaints in the studies participants instrumentalists found (32 - 34). Another aspect that may be responsible for the prevalence of neck pain found in this study is the increased tension in trapezoid caused by the need of the violinist and violist to maintain the support of the arch (32 - 34).

In the case of the presence of TMJD symptoms, pointed out in studies that composed this work, these can be justified by the instrument support posture in the viola and violin case, which is held between the Parliament and the left shoulder, causing that the head remains in combined bending ipsilateral rotation during performance (32 - 34). This positioning to support the violin between the chin and the shoulder has been highlighted in the literature as a factor that favors a mandibular deviation and an isometric contraction of the face muscles which favors an articulation shift of its physiological axis, without adequate stabilizing that can result in temporomandibular joint complaints (32, 33).

The literature also adds that both violinists and violists as the wind instrumentalists perform the protrusion head (32 – 34). The protrusion also puts the muscles and the rear fascia in permanent tension which can help, also cervical problems, as blood provision restrictions and appearance of nerve impingement that may impact on the structures of distal upper limb (32 – 34). This head position maintained for long hours associated with the instrument chin support, in the case of violin and viola, in instrumental practice favors the appearance of both TMJD and neck pain, according to the findings of this review (13, 35).

Regarding the prevalence of neck pain found in this study in wind instrument players, it can be highlighted that the presence of anti-physiologic postures as the forward projected head, the shoulders protrusion and internal rotation, confer risk factors like appearance of neck pain these professionals when compared to the violinist, as found in the literature (14). Authors state that the flute support, for example, is performed by a support point at the proximal phalange of the left hand index finger which presses the flute against the chin at the height of the piper lower lip (36). Another referenced point in literature is the right hand thumb that will press the flute in the opposite direction from the first point of support. These two forces have the function of balancing the instrument when the instrument is positioned between the flutist chin and the lower lip which favors an isometric trapezoidal region and upper limbs establishing the emergence of pains found in this study (36).

In addition, changes in temporomandibular joint can be caused in wind instruments because there is a muscular work required by the need to pump air through the nozzle. The literature suggests that there are different types of nozzles depending on the instrument. The trombone and trumpet have a mouthpiece like a cup in which the musician must force his lips. In the clarinet and saxophone the mouthpiece is between the lips that have to perform a sealing force so that the air does not escape with the support held at the bottom. In the flute the mouthpiece rests on the lower lip. In all cases the teeth can be affected, either by the nozzle pressure, the adjacent soft tissues or by the air column displaced, these could favor the appearance of occlusion problems, according to the literature (37).

It is added that specific training techniques for sound production. Through various nozzles, which is the position of the lips in a specific way to direct the air column against the nozzle, for producing bass,

middle and treble, as well as control of pitch and vibrato, directly influences the complex work of the temporomandibular joint and may cause TMJD as found in this study (36).

In this aspect, it was noted in the literature that biomechanical work is required in wind instrument, not only when the player performs the training and support, but also in the air column production and in the head, neck and shoulders position. Furthermore, there are the trunk, arms, hands and lower limbs positioning and maintenance of a postural balance while holding the instrument during a performance (35, 36). These anti-physiologic postures are necessary for the instrumental technique, however, these postural arrangements lead to muscle fatigue and, later, to the emergence of acute injuries which may become chronic, what corroborates the findings of this study (38). Beyond this, some postures favor the appearance of parafunctional activity of the stomatognathic system, as they require from the jaw and orofacial structures an effort beyond the physiological, important finding also evident in the present work studies (35, 39).

The literature also points out that both the musicians performing wind instruments as the bowed string, like the violin and viola, the upper limb elevated position for longer than three hours can cause more complaints, signs and symptoms in the cervical region (12).

Another point that may explain the symptoms found in this study is that both the flute and the violin are instruments supported completely by the musician with isometric muscle strength for a long time during the performance, especially of the neck, shoulder girdle and upper limbs and requires a certain degree of trunk and neck asymmetry posture. These postures can contribute to the emergence of chronic misalignment, disturbance of the static, joint rigidities, compressions, muscle weakness and changes in fascias, contributing to the emergence of pain (36). Associated with this, the frequency of instrumental practice and the profession time also that have been directly related to the musculoskeletal complaints in such instrumentalist (40, 41).

Regarding gender differences, this study reports in the literature a higher prevalence of TMJD and neck pain in female musicians, as well as musculoskeletal complaints for all regions of the body when compared to male musicians. This difference may be caused by the presence of a lower muscle strength and a greater joint hypermobility of the females when compared

to males (13). Associated with such factors the sex related hormones are also involved in pain perception, causing women to become more vulnerable to the symptoms (42).

Another point that favors the appearance of more constant pain in women than in men is also due to social issues of sexual division of housework. The literature reports that women generally have less time off work to activities that could shorten healthcare costs within their occupational activity (42).

Besides gender, the study showed researches where young instrumentalists also has pain complaints. The virtuosity charged in music conservatories has a direct impact on the osteomyoarticular structures of young professionals. Stringed instruments, like the violin, can influence the formation of craniofacial bones and the onset of malocclusion. The support of the instrument and the asymmetric position of the jaw combined with the intense practice can cause changes in the face growth of a young person, imbalances strength of the face muscle, causing joint pain during mastication, a stiffness feeling, teeth clenching, protrusion, muscle tension and deviation of the jaw (37).

Other instrumentalists, beyond the bowed string and wind instrumentalists, also had TMJD prevalence and neck pain found in this study, as in the case of pianists and electric guitarists. A study that evaluated the electromyographic activity of the masseter and temporal during the instrument execution and found that the activity of these musculature was almost four times higher compared with chewing. This fact was attributed to physical and psychosocial demands of performance and virtuosity, to concentration increased levels, stress and anxiety during the pianist activity (43). For guitarists, literature justifies that to run the instrument there is a shoulder lifting generating a tension in the cervical spine, this posture sustained for long hours of instrumental practice gives risk factor for the forthcoming of neck pain (44, 45).

Conclusion

The articles presented in this study reported that musicians have TMJD and neck pain complaints, particularly the wind players and rubbed strings like the violin and the viola. The study also pointed out that the wind players have a tendency to experience more symptoms of temporomandibular disorders

in relation to bowed string instruments players, and the neck pain symptoms are similar between the two types of instrumentalists.

These injuries are closely related to the requirements of the working musician, whether in work organization or, more prominent, in the anti-physiologic postures required in instrumental performance.

The proposed study aims to point the need to look at the musician as a worker who has profession advantages, but also the burden of overhead, unfortunately, a limitation of the study was the difficulty in finding population-based studies and that detailed the risk factors based on the movement biomechanics. Future reflections with larger populations could be developed, as well as studies based on biomechanical analyzes by type of instrument. In this context, this review aims to contribute to building reflections on the musician work and his demands required by their professional activity.

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