

From incidence to strategy: a systematic review in playing-related musculoskeletal disorders

Mário Cardoso¹, Elsa Morgado^{2,3,4}, Levi Leonido^{5*}

REVIEW ARTICLE

ABSTRACT

The intense performance and repetitive movements for a long period of time contribute to the developing of musculoskeletal disorders in instrumental musicians. This study aims to identify the major musculoskeletal disorders in the practice of the musical instrument and reflect on strategies to be used in the music teaching and learning process to reduce the risk factors for future musculoskeletal disorders. A systematic review of English and non-English articles using PubMed, Web of Science, and Scopus from 2015-2019. Additional studies were identified by searching abstracts presented at Medical Problems of Performing Artists (2015-2019) and Psychology of Music (2015-2019). Search terms included a combination of the keyword's musculoskeletal disorders, instrumental musicians, and music (n=187). From the systematic analysis pain, disabilities of the arm, shoulder, hand, neck, back and shoulders and temporomandibular, cervical muscle disorders and postural asymmetries are the major musculoskeletal disorders in the practice of the musical instrument. It is important to define preventive strategies to prevent and reduce the development of PRMDs in practitioners and performers.

Keywords: musculoskeletal disorders; instrumental musicians; music.

INTRODUCTION

The path a musician takes to musical performance is traditionally and institutionally polarized into two categories whose boundary is not very clear. On the other hand, the development of the technique capacity (related to concrete physical phenomena, regarding the handling of the musical instrument) and, on the other hand, the development of expressive capacity (related to the whole process of idealization of the sound phenomenon, which in turn come from intellectual and sensory processing). Undoubtedly both are fundamental in the process of musical achievement. Without technique, music is not made, and technique alone is not enough either. This is also readily apparent when watching a musical performance, where the boundaries between technique and

musicality are hardly distinguished, giving the impression that what is technically difficult seems easy. Thus, it is highly debatable that in the learning process, we can disconnect a technical-motor initiative from the sound outcome. Professional and pedagogical experience unequivocally reveals two pieces of evidence: (1) good technique allows greater fluidity of musicality and increases expressive possibilities; (2) poor technique can corrupt expressive abilities and, consequently, musical fluency. This relegates to the existence of a certain physical condition as a primordial requirement for fulfilling the demands of the musical text.

As in high-level competition, the music repertoire demands a very extraordinary level of technical requirements. The intense performance

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¹ Instituto Politécnico de Bragança, Bragança, Portugal.

² Universidade Católica Portuguesa, Braga, Portugal

³ Centro de Estudos Filosóficos e Humanísticos, CEFH, Braga, Portugal

⁴ Escola das Artes, Universidade Católica Portuguesa, Porto, Portugal

⁵ Centro de Investigação em Ciência e Tecnologia das Artes, CITAR, Porto, Portugal

⁴ Universidade de Trás-os-Montes e Alto Douro, Vila Real, Portugal.

* Autor correspondente: Departamento de Letras, Artes e Comunicação, Escola de Ciências Humanas e Sociais da UTAD, Quinta de Prados 5001-801. Vila Real. E-mail: levileon@utad.pt.

and repetitive movements for a long period of time contribute to the developing of musculoskeletal disorders (injuries or pain in the musculoskeletal system) in instrumental musicians. The requirement for artistic perfection through intense and prolonged practice without a proper break, increase the risk of developing a playing-related musculoskeletal disorder (PRMD). For Hamedon, Ling, and Loo (2019), the PRMD is a "form of repetitive strain injury caused by the repetition of a certain action or movement of the body" (p. 353). Many of this PRMD are associated with "pain, weakness, numbness, tingling, or other symptoms that interfere with the ability to play the instrument at the level you are accustomed to" (Zaza, Charles, & Muszynski, 1998, p. 47). Is important to say that many of this PRMDs are associated with several factors: (i) *intrinsic factors* (joint hypermobility, age, and gender) (Ranelli, Straker, & Smith, 2011; Yeung et al., 1999); (ii) *extrinsic factors* (warm-ups, playing hours, playing position, posture and playing techniques) (Kaufman-Cohen & Ratzon, 2011); and (iii) *psychosocial factors* (stage fright and anxiety) (Williamon & Thompson, 2006). For Ajidahun et al. (2017, p. 1), the "aetiology of PRMDs (a derivative of work-related musculoskeletal disorders) is multifactorial."

Over the last years, many studies strengthen that de musculoskeletal disorders are present in professional musicians and young music students (Frizziero et al., 2018; Hamedon, Ling, & Loo, 2019; Overton, Du Plessis, & Sole, 2018; Rensing, Schemmann, & Zalpour, 2018). In the case of young music students is important to improve and raise awareness of conscious practices and prevention strategies in the study of musical instrument.

The present study focuses on the systematic review of the musculoskeletal disorders in instrumental musicians. Specifically, the aims are: (i) identify the major musculoskeletal disorders in the practice of the musical instrument from 2015 to 2019; (ii) reflect about strategies to be used in the teaching and learning process to reduce the risks factors for future musculoskeletal disorders.

METHOD

A search for peer-reviewed articles was performed in the following electronic databases: *PubMed*, *Web of Science*, and *Scopus* from 2015 to 2019. A manual search was performed in the journals *Medical Problems of Performing Artists* (2015-2019) and *Psychology of Music* (2015-2019). We used the following keyword combinations to search all databases: (1) *musculoskeletal disorders*; (2) *instrumental musicians*; and (3) *music*. As in all systematic analysis, the present study required specific inclusion rules. The eligibility criteria were: (1) *participant* (professional instrumentalists and young music students); (2) *intervention* (research associated with PRMDs); (3) *outcome* (Musculoskeletal disorders); (4) *study design* (cohort, case-control and cross-sectional); and (5) *language* (English, Portuguese or Spanish). Ethical approval was not required for this review. However, all research procedures were conducted following the ethical aspects. All the studies were imported into the reference management software EndNote (Clarivate Analytics), and the duplicate articles/documents were removed. The selection process of the articles/studies was performed into the following phases (see Figure 1): (1) *identification phase*, two independent reviewers select potentially relevant articles/studies; (2) *screening phase*, two reviewers analysed the abstracts of the articles/studies select in the initial phase; (3) *eligibility/included phase*, all the articles/studies select in the previous phases were reviewed taking into account the specific eligibility criteria. Two assessors were involved in all the processes. Where doubt about articles/studies inclusion or exclusion existed, it was resolved by mediation and consensus among the reviewers in all the phases. The proportion of agreement over and above chance (Cohen's kappa) between the two quality assessors was based on the items for the 13 papers and was 0.765, $P < 0.001$, indicating substantial agreement.

RESULTS

A total of 13 studies were identified for inclusion in the review. The search on *PubMed*, *Web of Science*, and *Scopus* provide a total of 187 records. After adjusting for duplicates, 150

remained. Of these, 120 studies were discarded because after reviewing the abstracts, it appeared that these papers clearly did not meet the inclusion criteria. Seventeen studies were discarded because the full text of the studies was not available, or the paper could not be translated into English, Portuguese, or Spanish. The full text of the remaining 13 articles met the inclusion criteria and were then included in the systematic review. See the flow diagram in Figure 1.

Participant characteristics are presented in Table 1. The number of participants varied between 1 (Clemente et al., 2018) to 1470 (Selms et al., 2019). Five studies included professional (Maric et al., 2015; Sousa et al., 2019; Amorim et al., 2017; Clemente et al., 2018; Selms et al., 2019). One paper also included amateur musicians (Ajidahun et al., 2017). Seven papers also included music students or a combination of professionals and students (Baadjou et al., 2018;

Kok et al., 2016; Yasuda et al., 2016; Lacerda et al., 2015; Woldendorp et al., 2018; Kok et al., 2018; Frizziero et al., 2018). Mean age varied between 15 (Frizziero et al., 2018) and 67 years (Amorim et al., 2017). All papers included different instruments.

Studies outcomes reported complaints overall or specific complaints per body region. The PRMD were focused/described as pain, disabilities of arm, shoulder, hand, neck, back and shoulders and temporomandibular, cervical muscle disorders, and postural asymmetries. The outcome was often measured using a cross-sectional design, self-developed questionnaires, interview and case-control design (Amorim et al., 2017; Baadjou et al., 2018; Frizziero et al., 2018; Frizziero et al., 2018; Kok et al., 2016; Kok et al., 2018; Lacerda et al., 2015; Selms et al., 2019; Woldendorp et al., 2018; Yasuda et al., 2016).

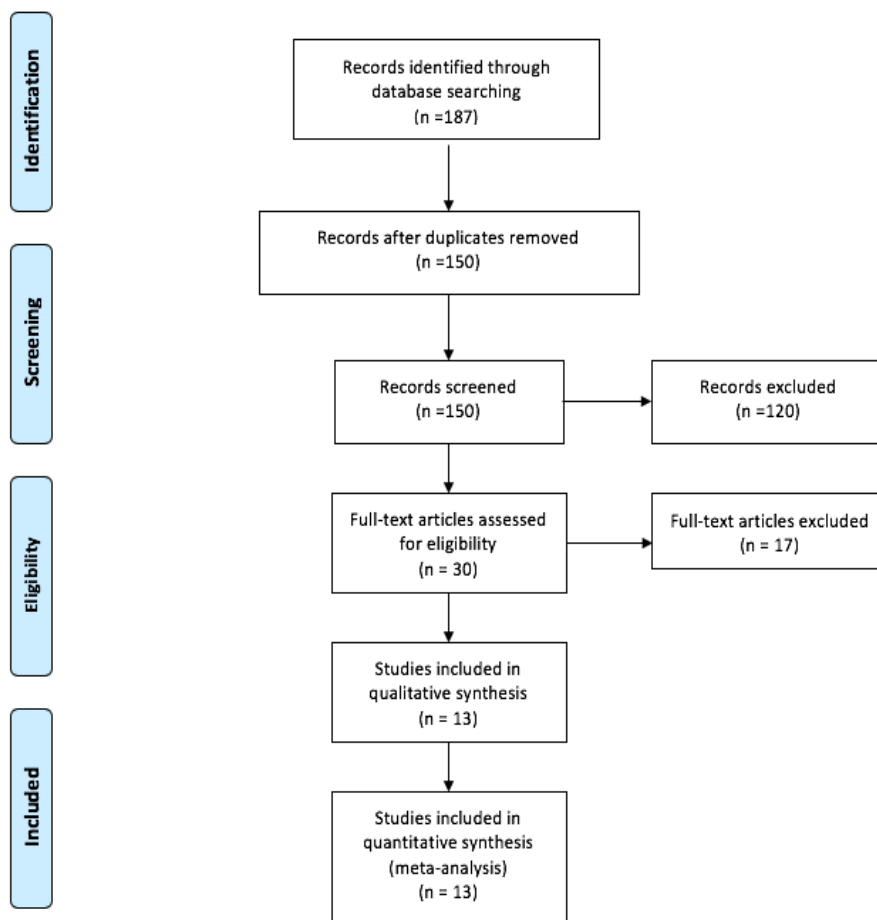


Figure 1. Flow chart of the search.

Table 1

Summary of included studies

Source	Participants	PRMDs	Year	Sample size	Age
Baadjou et al.	S	Disabilities of arm, shoulder, and hand	2018	n=130	±20
Kok et al.	S	Neck, back, and shoulders	2016	n=50	±20
Ajidahun et al.	P, A	Trunk and both shoulders	2017	n=17	28
Yasuda et al.	S	Temporomandibular and cervical muscles disorders	2016	n=210	±14
Lacerda et al.	S	Temporomandibular disorders	2015	n=41	NA
Woldendorp et al.	P, S	MSC in the neck, back, and shoulders	2018	n=141	NA
Maric et al.	P	Neck, region of trapezius, back, shoulder, wrist, hand, and arm	2015	n=50	21-58
Sousa et al.	P	Pain	2019	n=112	37,8
Amorim et al.	P	Temporomandibular disorders	2017	n=93	18-67
Kok et al.	S	Left shoulder, right hand, and wrist	2018	n=357	NA
Clemente et al.	P	Temporomandibular disorders	2018	n=1	30
Frizziero et al.	S	postural asymmetries	2018	n=32	15-32
Selms et al.	P	Temporomandibular disorders	2019	n=1470	±41,6

Note. P, Professional; A, Amateur; S, Student; NA, Not applicable.

DISCUSSION

Competitiveness and high level of performance efficiency lead professional, amateur, and student musicians to develop playing-related musculoskeletal injuries. This is a principle that derives from this systematic review. Many of the studies assume that the risk factors for playing-related musculoskeletal disorders in instrumental musicians were associated with "extensive training of repetitive and highly skilled movements" (Zamorano et al., 2015, p.1). For a long time, the physical preparation of the musician was not addressed or worked in the context of teaching and learning the instrument. The results and answers in the different paper-based questionnaires strengthen this point of view. Today we seem in the educational context and in the preparation of musical performance the necessity of existing practices and postures, which may prevent the onset of PRMD. Some of the excluded studies focused on prevention proposals (Baadjou et al., 2018; Davies, 2019; Shoebridge et al., 2017).

Another important point to highlight is the prevention or reduce the PRMD. A logical next step for the future is to develop research in this field as some studies emphasize the importance of physical preparation for the performance of musicians. Some of the studies make a comparison between the development of music players and the development of an athlete. This suggestion assumes particular interest if we think that athletes spend much of their practice in specific work to strengthen their muscles. For example, gym workouts allow the athlete to focus

on the muscles of the various parts of the body in order to strengthen them and acquire greater physical endurance. In the universe of the practice of musical instruments, this field of work corresponds to the performance of daily exercises in a systematic and analytical way: to enable more efficient technical development through body awareness in the systematic and methodical practice of daily exercise. This proposal is based on the idea that the physical preparation of a musician gains greater clarity and efficiency if not conditioned by a musical intention. This is where the main advantage of daily exercises lies: they are not designed for expressive purposes, but rather to isolate the core of the technical requirements of the repertoire, a kind of microscopic view of the problem. This allows us to focus on certain technical complexity and analyse body movement, without the concern of expressive framing. It is really about correctly applying body movement. Once the motor phenomenon is understood and systematized, the application of the acquired technical resourcefulness will make the expressive realization easier. This proposal in the educational and performative context intends to work the concrete of musical practice through the analysis of body awareness in the instrument technique. Looks at the old paradigm that separates technique from musicality, in the sense of matching technique to body awareness as being intricately linked to the intellectual, sensory structure, and expressive requirements. In this approach, the technique is not disassociated from the musical purpose, on the

contrary, it represents a mechanism that allows focusing a certain technical standard so that it can be properly developed through body awareness, so as not to corrupt the sound result. The study and practice of daily exercises are worthy of being a strong structure for obtaining technical skills, given their nature value the awareness of the relationship between the body and the instrument.

The organization of daily exercises based on analysis, reflection, framing with the repertoire of the instrument, and an appropriate development methodology, represents a solid effort to narrow the theory with the practice of the musical instrument. This posture may lead to the following benefits: (1) awareness of a more framed, conscious and preventive practice/study of the musical instrument; (2) the musician and teacher will be able to effectively adjust the exercises/repertoire to their specific technical needs; (2) direct framing with the repertoire of the instrument; (3) greater awareness of the body in relation to the instrument; (4) acquire a methodological basis for keeping muscles fit for performance; and (5) reduce the risks of PRMD.

CONCLUSION

In conclusion, this study suggests that the PRMDs assume relevance in the field of study and musical performance. It is important to define preventive strategies to reduce the development of PRMDs in practitioners and performers. In addition, an awareness about causative factors and injury prevention strategies may be useful in the educational programmes.

Following the above, an organized method of daily exercises can be a precision tool (strategy) in the development and study of the musician's technical activity. The process of technical improvement based on the systematic practice of daily exercises can be an effective mechanism for reducing performance errors and establishing a control platform for raising the levels of precision and technical mastery essential for proficient execution of musical literature.

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