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Coexistence of musculoskeletal disorders in the upper body of labor origin

Coexistencia de trastornos musculoesqueléticos en miembro superior de origen laboral

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ABSTRACT

The coexistence of musculoskeletal disorders is common in work activities around the world, however, information on the subject is insufficient both in Latin America and in Colombia despite its impact at the economic and social level. The objective of this research was to determine the coexistence of musculoskeletal disorders of work origin in the upper body in the working population that attends a Service Provider Institution (IPS). An observational, descriptive, quantitative, and cross-sectional design study was conducted between the first of March in 2017 and the first of March in 2018. Four semiological tests were applied for physiotherapists to seek the coexistence of carpal tunnel syndrome, lateral epicondylitis, rotator cuff syndrome, and cervical myofascial syndrome. Among the results, it was found that 92.6% (n=138) of the patients had two or more pathologies, 59.73% (n=89) had the rotator cuff and the myofascial syndrome, 52.35% (n=78) had epicondylitis and myofascial syndrome, and 37.58% (n=56) had carpal tunnel syndrome and lateral epicondylitis. This study highlights the high coexistence of musculoskeletal disorders in the upper body, especially in the female gender.

Keywords: Musculoskeletal Diseases; Tennis Elbow; Carpal Tunnel Syndrome; Painful shoulder syndrome; Rotator cuff syndrome; Occupational exposure.

RESUMEN

La coexistencia de trastornos musculoesqueléticos es común en actividades laborales de todo el mundo, sin embargo la información sobre el tema es insuficiente tanto en América Latina como en Colombia a pesar de su impacto a nivel económico y social; la investigación tuvo como objetivo determinar la coexistencia de trastornos musculoesqueléticos en miembro superior de origen laboral en la población trabajadora que asiste a una Institución Prestadora de Servicios (IPS); Se realizó un estudio de diseño Observacional, descriptivo, cuantitativo y de corte transversal, durante el periodo comprendido entre el primero de marzo de 2017 y el primero de marzo del 2018, se aplicaron cuatro pruebas semiológicas por fisioterapeutas para buscar la coexistencia de Síndrome de túnel del

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carpo, epicondilitis lateral, síndrome de manguito rotador y síndrome miofascial cervical; entre los resultados se encontró que el 92,6% (n=138) de los pacientes presentaban dos o más patologías, el 59,73% (n=89) síndrome de manguito rotador y síndrome miofascial, el 52,35% (n=78) Epicondilitis y síndrome miofascial y el 37,58% síndrome de túnel del carpo y epicondilitis lateral (n=56). El estudio pone en evidencia la elevada coexistencia de trastornos musculoesqueléticos en miembro superior especialmente en el género femenino.

Palabras clave: enfermedades musculoesqueléticas; codo de tenista; síndrome del túnel carpiano; síndrome de hombro doloroso; tendinitis del manguito rotador; exposición ocupacional.

INTRODUCTION

According to the World Health Organization (WHO)¹, musculoskeletal diseases (MSD) are one of the leading causes of workplace absenteeism and a promoter of the high costs of the public health system. MSDs are defined by WHO¹ as a health problem of the locomotion mechanism that affects the muscles, tendons, bones, cartilage, ligaments, and nerves, having a multifaceted origin that can be caused or aggravated by occupational risk factors.

According to the International Labor Organization² (ILO), each year around 160 million new cases of nonfatal occupational diseases are reported. These are the second leading cause of solicitations for economic benefits due to disability in countries that are part of the Organisation for Economic Cooperation and Development³. In Europe these these illnesses affect more than 40 million workers, and generate temporary incapacity in 50% of the cases of work origin MSD and permanent disability in 60%⁴. In Colombia, the Federation of Insurers⁵ (Fasecolda) reported in 2013 over 40,000 occupational diseases, of which 88% were MSD. In the same manner, Fasecolda⁵ and the latest Guide of Integral Attention Based on the Evidence for Musculoskeletal Disorders in Colombia⁶ have determined that the majority of diagnostics correspond to the upper body and spine.

Despite the fact that MSDs of work origin in the spine and upper body are commonplace in countries all over the world, the ability of statistical data is uneven and most of it comes from high income economies like the United States⁶, with a prevalence that varies according to the country due to basic demographic indicators, factors related to health and employment, work conditions, and the instruments utilized for their evaluation^{3,7}.

Mohammadpour *et al*⁸, among other authors, signal that exposure to occupational risk factors affect mostly the neck, back, and the upper extremities. Nevertheless, through a study conducted in the year 2017 in three Spanish-speaking countries, Campos *et al*⁷ warns that no study has evaluated the simultaneous effect of various anatomical sites in the upper extremities- an expression defined for this text as coexistence, meaning the existence of two or more concomitant MSDs or two or more MSDs simultaneously occurring in the same extremity caused, in this case, by the performance of workplace activities.

The lack of knowledge about the coexistence of MSDs in one extremity is also reflected in the Evidence Based Attention Guides⁶, where the treatment is circumscribed to a specific anatomical site and not to a complete body structure. Pilat⁹ proposes the human body's functional

anatomy should be treated from an integrally structural perspective that allows the establishment of a relationship between the MSDs, the biomechanical malfunctions that frame inadequate movement patterns, and that focus should be given to treatment to achieve the workers' successful rehabilitation and their reinsertion to their workplace activities.

As a result, without taking into account the coexistence or concomitance of various MSDs, the direction of treatment increases the consequences for the worker while causing a delay in the worker's rehabilitation, lowers the quality of life, and generates less productivity at work⁸. This situation impoverishes workers, and it can damage entire communities to lose its most productive company workers. As stated by OIT^{2,10}, this setting generates elevated costs to workers and their families, and it affects the countries' economic and social development to have a loss of 4% in each country's gross domestic product (GDP).

Having in mind the large scale economic impact of professional diseases, the insufficient information from Latin America and Colombia about work conditions, their effect on workers' health- in particular on a musculoskeletal level⁷ - and the absence of literature that identifies the incidences of MSDs that occur in a simultaneous fashion in the upper body, the objective is to determine the coexistence of upper body musculoskeletal disorders originating in the workplace in the working class that attend an institution that provides rehabilitatory services (IPS) in the city of Popayán.

MATERIALS AND METHODS

Type of Study

An observational, descriptive, quantitative, and cross-sectional study was realized in the period

included between the first of March of 2017 and the first of March of 2018.

Population and Sample Size

The study was carried out in a private sector physical rehabilitation center linked to the general Colombian social security system. 149 patients with different kinds of occupations were recruited for this study. Formal workers were referred by an occupational physician while informal workers were referred by a general physician who registered the association of the MSD with the work activity done by the patient in the clinic's history.

In order to be eligible for the study, patients had to display MSD in the neck and upper body. Workers with musculoskeletal disorders due to referred or visceral pain were discarded. The number of patients presented during the specified period with the previously mentioned characteristics and that had signed the informed consent form determined the sample size.

Procedure

For the implementation of this study, patients identified by the inclusion and exclusion criteria were first told about the offer, having the objectives and work plan explained to them. Following that, four semiological trials were applied by the physiotherapists from the IPS in order to determine the coexistence of at least two of the following MSDs in the same patient: carpal tunnel syndrome, lateral epicondylitis, rotator cuff syndrome, and cervical myofascial syndrome.

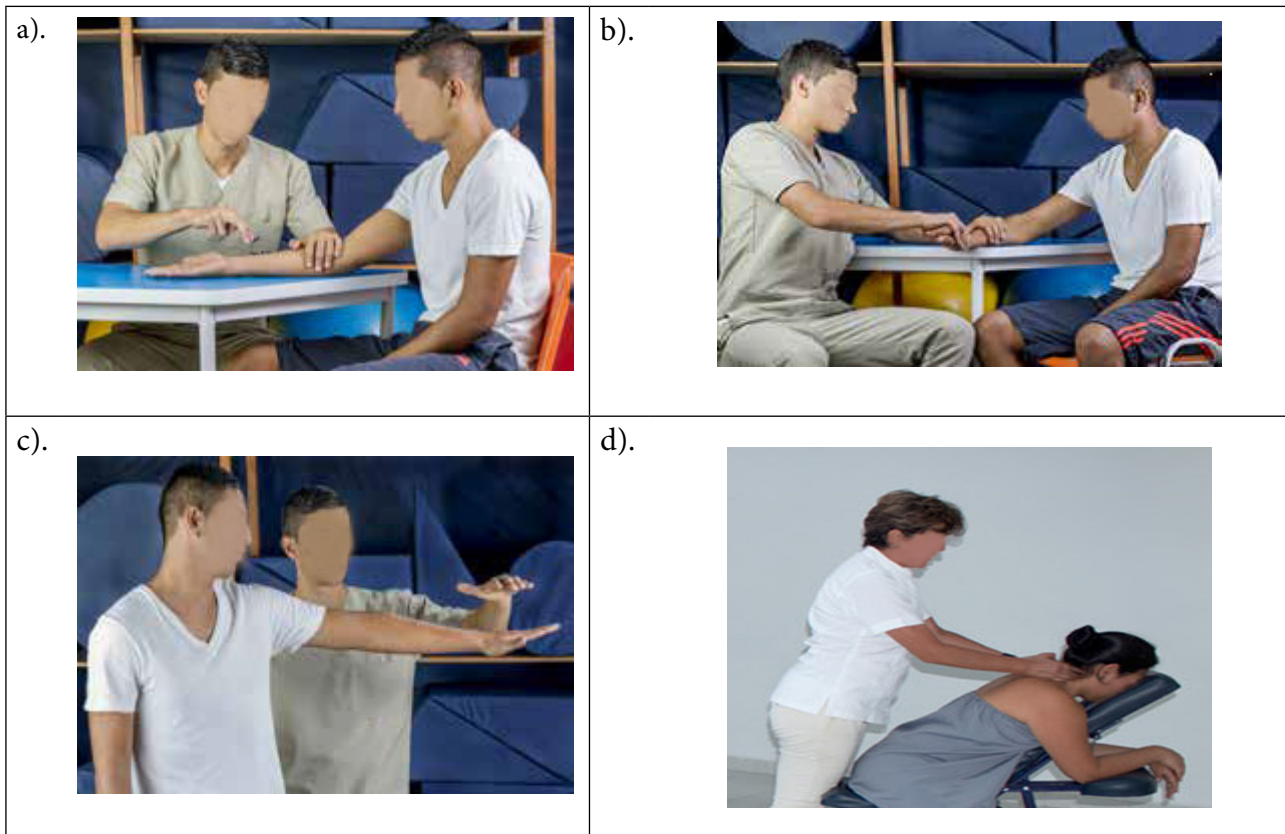
Tinel's sign was used, through which Carpal Tunnel is realized being generated as a stimulus over the median nerve. The reproduction of paresthesia accompanied by pain was registered as a Positive Tinel¹¹ (Figure 1a).

As to lateral epicondylitis, the patient was asked to extend the wrist against manual resistance aimed at the muscles of the external compartment of the elbow. The trial was considered positive at the emergence of pain and functional impotence¹¹ (Figure 1b). In respect to rotator cuff syndrome, abduction (90°) from a neutral position of the glenohumeral joint was asked of the patient, and manual resistance was applied.

Evidence of pain and functional impotence indicated presence of the syndrome¹¹. (Figure 1c).

In relation to cervical myofascial syndrome, a manual stimulus was applied to the occipito-cranial, upper trapezius, and levator scapula and interscapular trigger points. The syndrome was made evident with the appearance of pain and the withdrawal sign¹¹ (Figure 1d).

Figure 1. Source: Hormiga³⁰: a) carpal tunnel syndrome; b) lateral epicondylitis; c) rotator cuff syndrome; d) cervical myofascial syndrome.



Statistical Analysis

A field journal in Excel was used for the collection of data. In it, information related to gender, occupation, age, seniority in position, and a registra-

tion of the results of the semiological trials was consolidated. For the statistical analysis, the data was processed in SPSS version 17.0. A descriptive analysis of numerical and nominal data was made, a baseline was established for the variables

using the Kolmogorov-Smirnov test with the significance Lilliefors corrected, the correlation between the quantitative variables was explored using Spearman's coefficient (ρ) and a correspondence analysis using chi-squared test, with a confidence interval of 95% and a value of $p < 0.05$ accepted as statistically significant.

Declaration of ethical aspects

Ethical considerations were based on the Declaration of Helsinki¹², 1993's resolution 8430 of scientific investigation in Colombia which cataloged it as a no-risk study¹³, and 2012's law 1581 that overviews the protection of personal information¹⁴. The principles of totality, integrity, respect towards patients, the right to no maleficence, autonomy, welfare, justice, and equity were fulfilled, and the approval of the Committee of Investigations in the Faculty of Health Sciences in the University of the Cauca was accounted for. Participation was free and voluntary, and informed consent forms were signed giving participants the possibility to refuse or abandon the study at any time without any penalty.

RESULTS

Between March first, 2017 and March first, 2018, 149 patients with MSD in the upper body were evaluated, 100% ($n=149$) of which had some form of link to employment and performing diverse types of occupational roles. The gender distribution was 70% ($n=105$) feminine and 30% ($n=44$) masculine.

The average age was 50.4 ($s \pm 13.96$) years old for the entire sample population, 55.8 ($s \pm 13.32$;

Mo 57) for those of the female gender, and 51.8 ($s \pm 14.74$; Mo 57) for the male gender. The sample population in general had an average of 18.76 years of work experience, each in distinct areas. The women had an average of 18.97 years of work experience and the men 18.25. The numerical age and professional experience variables did not follow a normal distribution, but there was a positive or directly proportional correlation. In order to explore the correlation between the mentioned variables the Spearman coefficient (ρ) was applied, finding a positive association between both variables, establishing a relation directly proportional between age and general professional experience.

25% ($n=11$) of the men and 20% ($n=11$) of the women had vocational training. All of the pensioners were exclusively male, with a figure of 22.73% ($n=10$), though they still worked independently in commercial activities.

Since the participants were those who benefited from social security, activities linked to unprivileged administrative jobs were predominant in a manner surpassing a specific trade. 51 occupations were registered, grouped in five categories according to how similar each workplace activity performed was: Administrative (professionals and technologists who work in offices), Various occupations (in the case of women paid work related to the household, and in men activities of carpentry, gardening, and exterior cleaning). 100% of the women worked in activities related to the home, nevertheless only 34.22% ($n=51$) received payment for working in places other than their homes (Table 1).

Table 1. Grouping of jobs and professions according to gender.

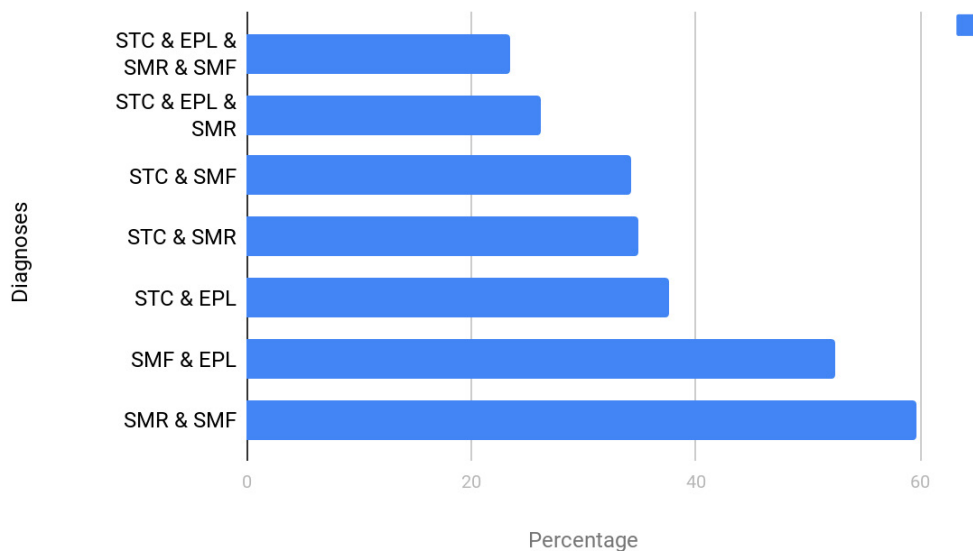
Groups	Masculine		Feminine		Total	
	n	%	n	%	n	%
Administrative	16	10.73	49	32.88	65	43.61
Various occupations	5	3.35	51	34.22	56	37.57
Commerce	14	9.39	5	3.35	19	12.71
Transport	6	4.02	0	0	6	4.02
Agricultural Activities	3	2.01	0	0	3	2.01
Total	44	29.5	105	70.35	149	100

In respect to medical referrals, it was found that 63.7% (n=95) of patients presented rotator cuff syndrome, 23.4% (n=35) carpal tunnel syndrome, 12% (n=18) lateral epicondylitis, and 10% (n=15) cervical myofascial syndrome. 7.3% (n=11) showed simultaneous carpal tunnel syndrome and rotator cuff syndrome, 0.6% (n=1) carpal tunnel syndrome and lateral epicondylitis, and 0.6% (n=1) had three diagnostics: carpal tunnel syndrome, lateral epicondylitis, and rotator cuff syndrome.

In the institutional action protocol, physiotherapists noted evidence of cervical myofascial syndrome in 81.9% (n=122) of the patients, rotator cuff syndrome in 73.8% (n=110), lateral epicondylitis in 63.1% (n=94), and carpal tunnel syndrome in 51.1% (n=76) of users. The semiological trials also allowed to show that 92.6% (n=138) of all patients presented two or more pathologies (Figure 1).

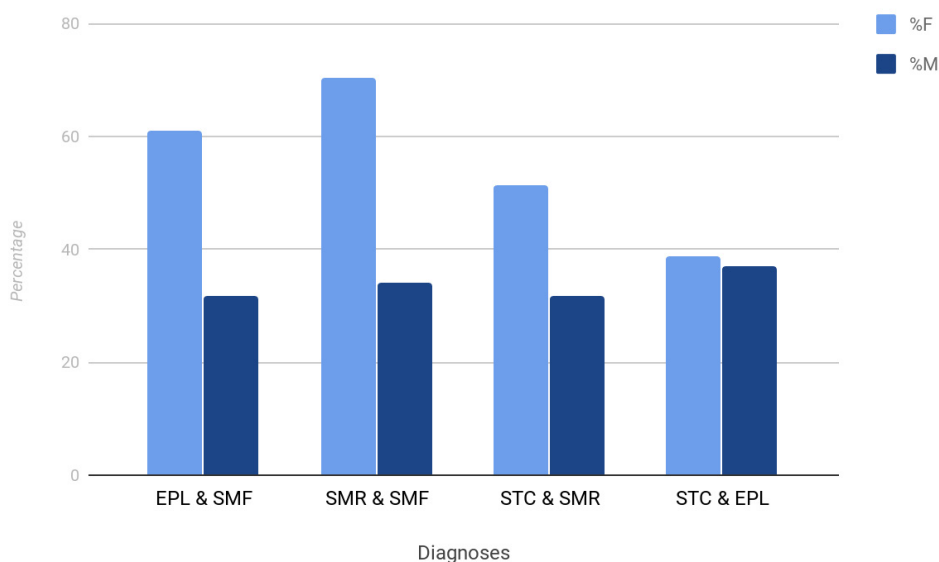
Figure 2. Coexistence of musculoskeletal disorders in the upper body, according to physiotherapeutic evaluation.

Coexistence of upper body musculoskeletal disorders



According to gender, the most commonly occurring osteomuscular injury in men was rotator cuff syndrome with a figure of 95.45% (n=42), followed by lateral epicondylitis with 61.3% (n=27). In women, the most commonly found disorder was cervical myofascial syndrome with a figure of 96.19% (n=101), followed by rotator cuff syndrome with 90.48% (n=95). On the other hand, the most frequent coexistence of MSD in both men and women was cervical myofascial syndrome (Figure 2).

Figure 3. Coexistence of musculoskeletal disorders in the upper body according to gender. SMR (rotator cuff syndrome); SMF (myofascial syndrome); EPL (lateral epicondylitis); STC (carpal tunnel syndrome).



A statistically significant relationship was found between gender and rotator cuff syndrome with myofascial syndrome ($p=0.00$), epicondylitis with myofascial syndrome ($p=0.00$), and carpal tunnel syndrome with myofascial syndrome ($p=0.02$).

DISCUSSION

The hypothesis was that patients with musculoskeletal disorders with an origin in labour presented more than one osteomuscular alteration in one single extremity, of which were not completely diagnosed by the occupational or general physician and led the patient to an unfocused rehabilitation treatment obligating physiotherapeutic or health professionals to perform an

exhaustive evaluation to identify the slow progress of the patient, and the deterioration in the patient's quality of life. This hypothesis was confirmed through the comparison between the coexistence of MSD in adults over the age of 50 and the doubled presence of women employed in paid work as well as being responsible for family and domestic chores as a risk factor¹⁵.

As to age, the results indicate a relationship directly proportional between age and total work experience, revealing a long time of exposure to occupational risk factors and therefore to suffer osteomuscular hurts. In one study completed in Lithuania by Kaliniene *et al*¹⁶, it was found that the frequency of MSD is greater in adults older than 50 years old, which is concu-

rred with the age of participants in this present investigation. Additionally, Kaliniene *et al*¹⁶ determined that these adults have between two to three times more of a chance of showing MSD in the shoulder, elbow, and wrist. Petreanu's¹⁷ opinion explains this by prolonged exposure to occupational demands that employees have throughout their professional lives, a situation which is reflected in this current study where patients have an average age of 50 years, exposure to occupational risk factors throughout at least 18 years (average) and coexistence of MSD in 92.6% of patients. However, it must be warned that recent changes in the organization of work have led to atypical trajectories, precarious work conditions, and unstable employment that make it difficult to relate age, work, and MSD¹⁷.

On the other hand, it was found that the gender that went most to rehabilitation due to MSD in the upper body was the feminine gender, coinciding with another investigation conducted in a call center in Bogota¹⁸ and a study from Central America about workers in all sectors¹⁹. In a similar fashion to this investigation, the highest percentage of the population that consulted IPS were women. To this it should be added that 100% of the participants had to meet the demands of their home and family, implying a greater workload and double the exposure to occupational risk factors. In the words of Ruiz *et al*¹⁵, this phenomenon has been called double presence and deepens osteomuscular lesions.

For its part, the European Agency for Safety and Health at Work²⁰ highlights some occupational risk factors for women such as work in specific sectors, the physical differences when compared to men, the fact of having to balance double the responsibility in the workplace and at home, the execution of jobs that are erroneously cataloged as safe and easy but expose them to risks that increase their vulnerability to occupational ill-

nesses. In this study, the most prevalent diagnosis in the female gender was myofascial syndrome. According to Nae J Dun J²¹, the ratio of women to men with this syndrome is approximately 9:1. Additional to this Muños J²² demonstrates that among its multiple causes one finds abnormal postures that are assumed during these work activities and points to absenteeism and inability to work as some of its main consequences.

The men, for their part, presented rotator cuff syndrome most often. However, in an epidemiological study conducted in the United Kingdom by White J *et al*²³ it was found that this pathology was more common in women than in men (90 against 83 cases per 100,000 people). Razmjou *et al*²⁴ explains that this situation is due not only to a woman's biological differences, but to the differences in gender from a social perspective in terms of access to resources or the inequalities that exist in order to be referred to a specialized evaluation.

As to the most common occupational diseases, the Second National Survey on Occupational Safety and Health Conditions of 2013²⁵ reported carpal tunnel syndrome as the pathology best known by Occupational Risk Insurers with an average of 42.5%, and rotator cuff syndrome and injuries or illnesses to the invertebrate disks as the fastest growing pathologies in 2012. Contrasting this, this investigation found that the most prevalent medical referral was rotator cuff syndrome, followed by carpal tunnel syndrome. Likewise, the semiological trials found rotator cuff syndrome as the second most frequent pathology.

In a similar manner, a systematic revision made by Costa *et al*²⁶ found that the incidence of rotator cuff syndrome shifted between 0.08 and 8 new cases per 100 workers, according to various activities and work conditions. In the same way,

lateral epicondylitis varied from 0.45 to 7 new cases per 100 workers.

In terms of coexistence, in a study conducted in China by Feng *et al*²⁷ it was found that 75% of dentists showed at least two MSDs in the upper body, of which 40% were bilateral disorders in the shoulder and 18% in the wrist. However, it must be emphasized the existing epidemiological data on these maladies is restricted to a specific structure and no record of these osteomuscular disorder is found, as well as records of physiotherapeutic diagnosis.

This investigation puts in evidence the coexistence of MSD through physiotherapeutic evaluation. It is a criteria of vital importance if one considers that this diagnostic is an opinion grounded on a rational critical analysis of all available information, as well as playing an important role in the security and safety at work as it can reduce the need for costly procedures, identify and prevent ailments, and promote wellness at work²⁸.

Gallego²⁹ assures that medical diagnostics are an important element, but does not comprise sufficient information to direct the rehabilitation process. This research seeks to reevaluate therapeutic intervention from a concept of an anatomical “one structure” in an isolated manner and to incorporate the evaluation and treatment in a holistic way taking into account the likely presence of coexistence of MSD in each patient.

LIMITATIONS AND RECOMMENDATIONS

As limitations of this study it should be mentioned that the final diagnoses of doctors and physiotherapists were assumed to be correct without additional objective tests such as electromyography (EMG), nuclear magnetic resonances (NMR), or ultrasounds. It should also

be noted that the diagnoses were assumed to be correct without establishing a causal relationship with the work activity performed, the analysis of workstation, ergonomic studies, and other analyzes of non-work factors.

Considering that the analysis was based on a relatively small population, it is recommended to expand upon the research of the coexistence of MSDs of work origin searching for an existing relationship between degree of occupation, work conditions, socioeconomic status, lifestyle, job analysis, non-work factors, and the agreement between medical and physiotherapeutic diagnoses, as well as developing performance protocols for health teams dealing with physical rehabilitation.

CONCLUSION

The coexistence of musculoskeletal ailments of work origin was present in a high percentage in the population of this study, with the most frequent appearances being rotator cuff syndrome and carpal tunnel syndrome, especially in the female gender. However, in the absence of objective confirmatory tests of the ailment as well as its relationship of causation as an ailment related to work, emerges the necessity to conduct investigations that show if there is an underdiagnosis on the part of the medical professionals or if on the contrary there is an overdiagnosis of work related ailments on the part of the physiotherapists.

DECLARATION ABOUT CONFLICTS OF INTEREST

The authors declare they have no conflict of interest in the execution of the work or the drafting of the manuscript.

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