Impact of the Use of Neoprene Orthosis, in the Work Context, in Individuals with Wrist and/or Hand Disorders

Impacto da Utilização de Ortóteses de Neoprene, em Contexto Laboral, em Indivíduos com Disfunções no Punho e/ou Mão

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Abstract

Introduction: *Our objective was to evaluate the impact of using neoprene orthosis in wrist and/or hand disorders, in the workplace.*

Methods: *The sample is non-probabilistic for convenience and in a total sample of 15 adults, 7 individuals were in the control group and 8 in the intervention group. The variables considered in this study were the overall muscle strength of the hand and pinch, protective sensitivity of the hands, perception of pain and functionality of the upper limb. To measure these variables, Nordic Musculoskeletal Questionnaire, Quickdash, Semmes-Weinstein Monofilament Test, manual dynamometer (Jamar) and clamp dynamometer (Jamar) were applied. For the participants of the intervention group, two orthosis in neoprene were made, one for each hand, covering the thumb and wrist joints, with 5.5 mm of thickness; this group also had therapeutic education.*

Results: *Regarding the sensitivity assessment at the first moment of evaluation, there are no significant differences observed, with the exception of the S1 area of the left hand. Generally, the intervention group showed greater gains than the control group, with statistically significant differences in the strength of the right and left hands digital pinch, sensory areas S2 of the right hand and S5 of the left hand and functionality of the upper limb.*

Conclusion: *After conducting this study, it is possible to see that the intervention group showed general improvements in all variables, which may suggest the effectiveness of using neoprene orthosis in the workplace.*

Keywords: *Musculoskeletal Diseases; Neoprene; Occupational Health; Occupational Therapy.*

Resumo

Introdução: O nosso objetivo foi avaliar o impacto da utilização de ortóteses de neoprene em disfunções do punho e/ou mão, em contexto laboral.

Métodos: Amostra não probabilística por conveniência, constituída por 15 indivíduos adultos. Do total da amostra, 7 indivíduos pertencem ao grupo controlo e 8 indivíduos ao grupo de intervenção. As variáveis consideradas neste estudo foram a força muscular manual e de pinças, sensibilidade protetora das mãos, dor e funcionalidade do membro superior. Para a medição destas variáveis foram aplicados o Questionário Nórdico Musculosquelético, Quickdash, Teste de Monofilamento de Semmes- Weinstein, dinamómetro manual (Jamar) e pinçometro (Jamar). Para os participantes do grupo de intervenção, foram confecionadas duas ortóteses em neoprene, uma para cada mão, abrangendo as articulações do polegar e punho, com 5,5 mm de espessura; este grupo também teve educação terapêutica.

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Data de submissão: setembro 2022
Data de aceitação: fevereiro 2023
Data de publicação: junho 2023

Resultados: Em relação à avaliação da sensibilidade no primeiro momento de avaliação, não foram observadas diferenças significativas entre os grupos, com exceção da área S1 da mão esquerda. De forma global, o grupo de intervenção apresentou maiores ganhos do que o grupo controlo, com diferenças estatisticamente significativas na pinça digital das mãos direita e esquerda, zonas de sensibilidade S2 da mão direita e S5 da mão esquerda e na funcionalidade do membro superior.

Conclusão: Com a realização deste estudo, constatou-se que o grupo de intervenção apresentou melhorias generalizadas em todas as variáveis, o que pode sugerir eficácia da utilização das ortóteses de neoprene em contexto laboral.

Palavras-chave: Doenças Músculo-Esqueléticas; Neoprene; Saúde Ocupacional; Terapia Ocupacional.

Introduction

Work-related musculoskeletal disorders (WMSDs) are pathological states of the musculoskeletal system, resulting from an imbalance between the movements requested in the work context and the adaptability of the body region used, during a period of time in which the recovery from fatigue is insufficient. These injuries are provoked or aggravated by work, having increased mainly in the last decades.[1,2]

The etiology of WMSDs is described as multifactorial, arising from the worker's exposure to several risk factors, which are of physical/ergonomic, individual and psychosocial/organizational origin.[1–3]

The symptoms of WMSDs include localized pain, which can radiate to other body regions than the affected one, local paresthesias or in the adjacent areas of the lesion, heaviness, localized discomfort and, finally, sensation or even loss of muscle strength. The manifestation of these symptoms vary depending on the individual, as not everyone has the same visible signs of injury, due to individual differences, however the symptoms are usually common to all cases.[4]

The hand and wrist joints are the regions most affected by the symptoms of WMSDs, so one of the preventive and/or interventional approaches that can be used in the work context, is the use of neoprene orthosis. Occupational therapists are trained to make neoprene orthosis in a personalized way, respecting the anthropometric characteristics of each individual. This material option allows the orthosis to be used in the workplace due to their elastic capacity, high tensile strength and their comfort.[5] These characteristics are an advantage in the work context, and these orthoses can be made in different thicknesses: 5.5 mm, 3.5 mm or 2 mm. The choice of thickness must fall on the joint in which it will be used. Thus, the thickness of 3.5 mm is more used in finger orthosis and 5.5 mm in wrist orthosis, which was used in this study.[5–7] The objective of this study was to evaluate the impact of using neoprene orthosis and therapeutic education in wrist and/or hand disorders, in the workplace.

Material and Methods

This study is of an experimental quantitative nature, and the sampling method is classified as non-probabilistic for convenience. The sample was inserted in an assembly line sector, which was previously selected by the textile factory, since workers in this sector were exposed to risk factors such as repetitive manual tasks. Posteriorly the workers in that sector were selected by the researcher according to the inclusion and exclusion criteria.[8] The inclusion criteria were: adults (at least 18 years old); at least two values above 2.83 in the Semmes-Weinstein Monofilament Test; muscle strength values (kgf) of the non-dominant hand higher than the values of the dominant hand, in the manual dynamometry and pincometry tests; mention of pain in the Nordic Musculoskeletal Questionnaire (NMQ) in the structures of the upper limb and/or values greater than 3 on the analogue pain scale in the same body region. Pregnancy and having a diagnosis of WMSDs were defined as exclusion criteria. Since general regular exercise is described to prevent the appearance and development of WMSDs, it was defined as well to be part of the exclusion criteria.[9]

The radial nerve is responsible for the innervation of the S7 zone, the median for the innervation of the S1, S2 and S3 zones and the cubital for the innervation of the S4, S5, S6 and S8 zones.[10] Thus, the application of the Semmes-Weinstein Monofilament Test encompasses the assessment of all the sensory nerves of the hand.

The sample was randomized in order to avoid bias in the results obtained, with each participant having the same probability of being allocated to the intervention and control groups. All data were collected by the same investigator, an occupational therapist, who later made all the neoprene orthosis for the study participants.

An Informed Consent Term based on the Declaration of Helsinki was signed by all participants. All participants were informed of the purpose of this study and could withdraw at any time without any consequences.

The textile factory made it possible for the assessments and interventions to be carried out in an assembly line sector. From the available population (16 employees), 15 participants were selected because one participant fell within the exclusion criteria (regular exercise). Throughout the study, three of the participants dropped out, one due to the impossibility of carrying out the evaluations and two due to the end of the work contract.

In order to guarantee anonymity, an alphanumeric code was assigned to each participant.

Initially, an assessment was carried out (moment 1) in order to ascertain the collaborators who fit the inclusion and exclusion criteria, through the application of the NMQ, The QuickDash (DASH), Semmes-Weinstein Monofilament Test, Manual dynamometry and Pincometry. After selecting the sample, and due to the study design, the employees were divided into two groups, one with individuals with more than 5 years of work in the factory and the other with less or up to 5 years of work in the same. Subsequently, a randomization program was used, where half of the individuals in each group were randomly selected for the intervention group and the rest for the control group. After three months, both groups were re-evaluated (moment 2) with the tests used at moment 1.

The intervention was carried out after data collection at moment 1, consisting of the making of two 5.5 mm neoprene orthosis for each employee's wrist and thumb, as well as therapeutic education, which was based on the transmission of information about the advantages of using the orthosis, general information about WMSDs and teaching ergonomic hand movement patterns. The intervention was performed exclusively by an occupational therapist, who made the orthosis with the specific characteristics of each participant. The intervention group received the intervention at the beginning of data collection, while the control group, for ethical reasons, received the same intervention at the end of the study. Two neoprene orthosis were made for each employee, since the entire sample presented data that suggested injury to both hands in the application of the tests. Employees were advised not to use both orthosis simultaneously, so as not to compromise their work performance.

The use of orthosis was contemplated for the first two hours of the work cycle, since it is at this stage that injuries are more likely to develop.[11] To ensure a consistent use of the orthosis, a follow-up of adaptation to the orthosis was carried out once a month by the occupational therapist for three months until the beginning of the evaluations at moment 2. Orthosis were used an average of two mornings per week, one hour for each hand separately, in order to minimize the impact on the workstation. At the end of the study, a perception questionnaire was filled out, in order to assess the main difficulties of using orthosis in the work context, in this sample.

Version 25 of the SPSS statistical program was used to perform the statistical analysis of the data. These were organized in a database, and later, a descriptive analysis of sociodemographic data was carried out. Nominal data were represented by absolute (n) and relative (%) frequency and scalar data were represented with measures of central tendency (means) and dispersion (standard deviation). In comparing the differences between groups, the nonparametric test for independent Mann-Whitney samples was used. In the comparison between evaluation moments, the Wilcoxon paired sample hypothesis test was used.

The NMQ is translated and validated for the Portuguese population, has a degree of reliability between 0.8 and 1 (strong to very strong association) and an internal consistency of 0.855, having evaluated the structures of the neck, shoulders, elbow and wrist/ hands.[12]

The DASH has a Cronbach's alpha of 0.95, and was completed by the participants themselves, not having completed the optional modules.[13,14]

Manual dynamometry evaluated manual strength, while Pinçometry evaluated lateral pinch, digital pinch and triad. The degree of reliability of this instrument is r=0.98.[15–18]

The Semmes Weinstein Monofilament Test evaluated the six points on the palmar face and the point on the dorsal face of the hand, all recommended in the use of this test.[19]

The participants' satisfaction/perception questionnaire aimed to collect the sample's perception of the study. It included questions about the relevance of the study, perception of improvements in the variables, average time of use of orthosis (days per week) and difficulties in using them. This questionnaire was subject to evaluation by a panel of experts, composed of professionals from the technical-scientific area of School of Health of Porto - Polytechnic of Porto.

Results

The sample of this study has a total of 15 participants, 7 belonging to the control group and 8 to the intervention group. There are no statistically significant differences in the sociodemographic variables ($p>0.05$) that characterize the sample (Table 1).

Table 2 presents the results of the differences between the evaluation moments, as well as between the control group and the intervention group, in the evaluation of strength. The higher the average value, the greater the force (kgf) presented. In the comparison between the groups, the control group in M1 showed higher values than the intervention group, with the exception of the right lateral pinch, left manual force and left lateral pinch. Moving on to M2, there are no significant differences between the groups (p>0.05), similar to M1. Even so, it is possible to verify that in M2 the intervention group presented higher values than the control group in the right hand strength, right digital pinch, right triad (three-fingered pinch) and left lateral pinch. In the comparison between the evaluation moments, it is possible to observe that the intervention group demonstrates a generalized increase in the values of the variable muscle strength, with the exception of the right lateral pinch. Significant differences in the values of this group are found in the right digital pinch (p=0.03) and left digital pinch (p=0.04).

Table 3 presents the results of the differences between the evaluation moments and differences between the control group and the intervention group, in the sensitivity assessment. The higher the mean values, the more severe the sensory alteration. The sensitive areas are those recommended in the test, having the denomination of Sx depending on the area evaluated.

In the comparison between the groups, the intervention group showed greater sensory deficits than the control group in all areas of both hands at the two evaluation moments. There are only significant differences between groups in the S1 area of the left hand (p=0.03).

Regarding the comparison between the evaluation moments, the intervention group showed improvements in all areas of the dominant hand, with significance in the S2 area (p=0.04). Regarding the non-dominant hand, areas S2 and S3 show a worsening of the average values, while the remaining areas show improvements. Area S5 shows a significant improvement (p=0.04) in the passage from M1 to

Table 1 - Characterization of the variables that characterize the sample in terms of mean (M), standard deviation (sd), absolute (n) and relative (%) frequency and differences between groups.

		Control Group	**Intervention Group**	***p-value***
		M(dp)	M(dp)	
Age (years)		40.43 (12.09)	49.75 (11.15)	0.13
		n (%)	n (%)	*p-value*
Dominant hand	Right	7	8	1.00
	Left	0	0	
Gender	Feminine	5	5	0.57
	Masculine	2	3	
Years in the factory	Less or equal to 5 years	5 (71.40%)	5 (62.50%)	0.57
	More than 5 years	2 (28.60%)	3 (37.50%)	
Schooling	Basic education	2 (28.60%)	3 (37.50%)	0.57
	High school	5 (71.40%)	5 (62.50%)	
Marital status	Single	1 (14.30%)	1 (12.50%)	0.73
	Married	6 (85.70%)	7 (87.50%)	

p-value≤0.05

Table 2 - Differences between the evaluation moments and between the control and intervention groups, in the evaluation of strength (kgf), in the first evaluation moment (M1) and in the second evaluation moment (M2), in terms of mean (M) and deviation default (dp).

			Control Group	Intervention Group	*p-value**
			M(dp)*	M(dp)*	
Right	Hand strength	M1	32.04 (7.81)	29.95 (11.04)	0.69
		M2	32.40 (8.44)	32.72 (5.96)	0.75
	*p-value**		0.75	0.50	
	Lateral pinch	M1	6.47 (2.60)	7.13 (1.73)	0.64
		M2	7.22 (2.94)	6.90 (1.49)	0.87
	*p-value**		0.25	0.46	
	Digital pinch	M1	5.03 (1.80)	4.44 (1.71)	0.56
		M2	5.29 (2.05)	5.93 (1.51)	0.87
	*p-value**		0.29	**0.03**	
	Triad	M1	6.41 (1.55)	5.75 (2.24)	0.73
		M2	6.88 (1.57)	6.98 (1.64)	1.00
	*p-value**		0.40	0.75	
Left	Hand strength	M1	27.19 (6.85)	27.25 (12.37)	0.91
		M2	30.83 (8.35)	29.67 (4.10)	0.87
	*p-value**		0.08	0.60	
	Lateral pinch	M1	6.66 (1.67)	6.97 (2.32)	0.82
		M2	6.85 (2.02)	7.43 (1.52)	0.42
	*p-value**		0.46	0.46	
	Digital pinch	M1	4.57 (1.99)	3.82 (1.22)	0.56
		M2	5.09 (1.85)	5.30 (1.44)	0.87
	*p-value**		0.46	**0.04**	
	Triad	M1	6.97 (2.15)	5.81 (1.98)	0.49
		M2	6.47 (1.36)	6.12 (1.62)	0.75
	*p-value**		0.60	0.75	

p-value≤0.05

M2. The control group also showed improvements in all areas of the dominant hand, with no significant differences to be observed. In relation to the non-dominant hand, the areas S1, S3 and S4 show an aggravation of the average values from M1 to M2. Areas S2, S5, S6 and S7 show an improvement in the average values from M1 to M2, without any statistically significant change.

Next, in Table 4, the results of the differences between the evaluation moments and the differences between the control group and the intervention group, in the evaluation of the NMQ, are presented. The higher the mean value, the greater the perception of pain in the referenced segment.

In the comparison between the groups, the intervention group presents higher mean values of pain perception in all

Table 3 - Differences between the evaluation moments and differences between the control and intervention groups, in the evaluation of sensitivity in evaluation 1 (M1) and 2 (M2), in terms of mean (M) and standard deviation (sd).

			Control Group	Intervention Group	*p-value**
			M(dp)*	M(dp)*	
Right	S1	M1	3.14 (0.66)	3.60 (0.56)	0.14
		M2	3.13 (0.47)	3.27 (0.61)	0.68
	p-value*		0.89	0.42	
	S2	M1	3.19 (0.61)	3.62 (0.36)	0.16
		M2	3.03 (0.41)	3.19 (0.51)	0.51
	p-value*		0.68	**0.04**	
	S3	M1	3.33 (0.59)	3.41 (0.84)	1.00
		M2	3.06 (0.48)	3.21 (0.64)	0.74
	p-value*		0.68	0.14	
	S4	M1	3.23 (0.65)	3.48 (0.61)	0.41
		M2	3.16 (0.46)	3.27 (0.66)	0.68
	p-value*		1.00	0.60	
	S5	M1	3.35 (0.68)	3.81 (0.61)	0.32
		M2	3.09 (0.40)	3.39 (0.37)	0.21
	p-value*		0.40	0.18	
	S6	M1	3.39 (0.72)	3.84 (0.54)	0.41
		M2	3.26 (0.41)	3.32 (0.43)	0.80
	p-value*		0.89	0.07	
	S7	M1	3.65 (0.26)	3.89 (0.25)	0.11
		M2	3.42 (0.21)	3.64 (0.35)	0.20
	p-value*		0.07	0.08	
	S1	M1	2.83 (0.45)	3.60 (0.73)	0.03
		M2	2.90 (0.46)	3.13 (0.47)	0.36
	p-value*		0.67	0.17	
	S2	M1	2.89 (0.52)	3.10 (0.51)	0.30
		M2	2.77 (0.46)	3.16 (0.46)	0.16
	p-value*		0.66	0.41	
	S3	M1	2.83 (0.55)	3.20 (0.69)	0.23
		M2	3.06 (0.48)	3.21 (0.64)	0.74
	p-value*		0.22	0.45	
	S4	M1	2.89 (0.47)	3.24 (0.35)	0.13
		M2	2.90 (0.29)	3.03 (0.41)	0.55
	p-value*		0.66	0.27	
	S5	M1	3.14 (0.58)	3.42 (0.36)	0.34
		M2	3.02 (0.41)	3.03 (0.41)	1.00
	p-value*		0.59	**0.04**	
	S6	M1	3.36 (0.34)	3.48 (0.44)	0.63
		M2	3.22 (0.43)	3.29 (0.46)	0.80
	p-value*		0.71	1.00	
	S7	M1	3.60 (0.28)	3.81 (0.15)	0.11
		M2	3.41 (0.33)	3.60 (0.39)	0.14
	p-value*		0.59	0.11	

p-value≤0.05

Table 4 - Differences between the assessment moments and differences between the control and intervention groups, in the assessment of the Nordic Musculoskeletal Questionnaire, in evaluations 1 and 2 (M1, M2), in terms of mean (M) and standard deviation (sd).

		Control Group	Intervention Group	*p-value**
		M(dp)*	M(dp)*	
Neck	M1	0.71 (1.25)	2.37 (2.13)	0.08
	M2	1.83 (2.04)	2.17 (2.79)	0.93
p-value*		0.11	1.00	
Shoulders	M1	1.14 (1.95)	2.50 (3.07)	0.23
	M2	2.17 (1.72)	2.17 (4.02)	0.43
p-value*		0.59	1.00	
Elbow	M1	0.00 (0.00)	1.25 (2.31)	0.17
	M2	0.50 (1.22)	1.67 (4.08)	0.90
p-value*		0.32	0.32	
Wrist and Hands	M1	2.42 (2.44)	3.63 (1.92)	0.40
	M2	2.50 (2.07)	3.17 (3.87)	0.93
p-value*		0.71	0.79	

p-value≤0.05

Table 5 - Differences between the control and intervention groups, in the DASH assessment, in evaluations 1 and 2 (M1, M2), in terms of mean (M) and standard deviation (sd).

		Control Group	Intervention Group	*p-value**
		M(dp)*	M(dp)*	
Main	M1	404.29 (187.87)	456.25 (205.18)	0.77
	M2	545.83 (233.14)	454.17 (173.51)	0.69
p-value*		0.07	**0.04**	

evaluated segments, compared to the control group. There are no significant differences ($p>0.05$) between groups in any of the segments evaluated at any time.

Regarding the comparison between evaluation moments, the intervention group showed non-significant improvements in all segments, with the exception of the elbow, which showed a worsening from M1 to M2. The control group, on the other hand, shows a worsening of the average values of pain perception in all the evaluated segments, with no significant results to be mentioned.

In the next Table, the results of the differences between the evaluation moments and between the control group and the intervention group are presented, in the DASH evaluation. The higher the value presented, the worse the level of functionality of the upper limb.

The intervention group has a higher average value than the control group in M1, which translates into a greater functional deficit. In M2, not only did the intervention group significantly increase its upper limb functionality ($p=0.04$), but also presented lower mean values compared to the control group. There were no significant differences between the groups at any time.

Discussion

The present study aimed to evaluate the impact of using neoprene orthosis on wrist and/or hand disorders, in a manufacturing context. In general, it is possible to say that the use of neoprene orthosis had positive effects on the evaluated sample.

The probability of developing an injury increases with the time of exposure to risk factors, with some workers working with this factory for at least 5 years.[1–3] In the study by Schneider,[20] it is possible to observe that there is a relationship between the fact that workers with less experience develop

injuries, when compared to more experienced workers. Carrying out a more detailed analysis of the sample under study, it is possible to verify that the variable "number of years in the factory" can impact the results of the sample, both due to the time of exposure to risk factors and the differences in experience between the participants.

Working on assembly lines, in which all participants in the sample are involved, requires repetitive movements over long periods of time, which are one of the main causes of hand joint injuries. [1] For this reason, it is understandable that the values found in the first evaluation, both in the control and intervention groups, suggest the presence of symptoms related to WMSDs.

The muscular strength was considered as a variable to be evaluated, in virtue of the great variations that it suffers in the WMSDs.[1–3] With the installation of injury, there is usually loss of muscle strength, which drastically reduces the ability of the body structure to withstand the mechanical changes to which it is subject.[10] According to the results, from M1 to M2, there was a generalized improvement in strength assessed in both groups. According to Kiyama,[21] both repetitive and continuous muscle contraction cause muscle fatigue, which consequently reduces the maximum contraction of voluntary force that the individual is capable of producing. If fatigue is not reduced by muscle recovery, a WMSDs may develop and the strength of the entire hand structure is compromised.[1,2] Thus, according to the developmental patterns of WMSDs over time, it would be expected that the strength of the intervention group would increase or be maintained, while that of the control group would decrease or at least not increase, since there was no intervention.[22,23] In fact, in this study it was found that both groups showed an increase in generalized muscle strength, however, when performing a more detailed analysis of the results, it is possible to verify that the intervention group presents higher average values. Since all the participants worked in the same place, it is possible that there was an adoption of more ergonomic and adjusted behaviors by the participants of the control group. These data may indicate that the intervention had a positive impact on the intervention group and was possibly the differentiating factor between the gains of both groups.

According to the literature, in healthy individuals the dominant hand has strength values higher than the values of the non-dominant hand.[17,24] In individuals with WMSDs, it is observed that these values may vary, that is, the dominant hand is not always necessarily the one with the highest values.[25]

Thus, all the higher values of the non-dominant hand of the control group (Table 6), are possibly justified by the presence of WMSDs. It is also possible to verify that the age of the participants is between 40 and 50 years old, which corresponds to an age group susceptible to developing WMSDs. Boenzi[26] reports that individuals between 40 and 60 years of age have a higher prevalence of developing these lesions, since at these ages, the body's physiological responses decrease. This reality may also contribute to the muscle strength values found, derived from the susceptibility of the study sample to develop WMSDs.

Exploring in more detail the data related to the muscle strength variable, it is possible to observe a significant improvement in the digital pinch of the intervention group in both hands. Also in the remaining grips, the intervention group showed an increase in values over time, so once again it can be said that therapeutic education and the use of orthosis can play a leading role in these gains. The role of therapeutic education is related to minimizing the functional losses of structures. This intervention methodology is particularly important in preventing the development of WMSDs, as only a worker who is well-informed about the symptoms and risks to which he is subject can fully cooperate in the objectives set for his work activity and minimize the risk of developing injury.[1,2] Hammond[27] with his therapeutic education program obtained positive results in improving strength, functionality and knowledge about the pathology, despite the results being pointed out as not significant due to the small sample size. In turn, according to Duarte,[5] the use of neoprene orthosis makes possible to increase hand muscle strength in the workplace. No plausible justification was found for the loss of strength in the right lateral pinch in the intervention group, however we can consider that the fact that it is a type of grip that generates discomfort may not be recruited as well and may not have undergone positive changes.

Regarding the sensitivity variable, the values obtained in the Semmes-Weinstein Monofilament Test were considered, in the 7 sensitive areas recommended in this test.[19]

Both groups have a predominance of females, which according to Binderup[28] and Ferreira,[29] is the gender most likely to be able to develop WMSDs. Physiological differences such as strength and hormonal components are factors that lead to greater exposure to risk factors in the work context. It is consensual that the presence of WMSDs or continuous exposure to risk factors can lead to protective sensitive changes in the hand, such as pressure, temperature and pain.[1,2]

Duarte[5] refers to the sensitive benefits of using neoprene orthosis. Thus, it is possible to associate the gains in this variable in the intervention group with the use of neoprene orthosis in the work context. Contrary to what was expected, the sensitivity values of the control group reveal a general improvement in both hands, with the exception of areas S1, S3 and S4 of the left hand, which show a worsening of the mean values. Once again, considering that the elements of both groups carry out their professional activity together, one can try to explain these results with a possible change in harmful behaviors during work activities by the control group. In order for sensitivity to improve, nerve decompression in the area with changes is necessary. Both groups continue to show decreased sensitivity values in both hands, possibly due to the fact that the time of application of the intervention is still not enough, however it is visible that the intervention group presents greater gains. Veras[30] was unable to relate the loss/gain of muscle strength with the change in sensitivity, however they report that the loss of sensitivity “predates motor dysfunction due to the continuous loss of motor axons”. Brown[31] states that the sensory changes accompany the loss of muscle strength, even though the study population is quite different.

The participants are mostly female, and anthropometric differences are a disadvantage for this gender, since according to Queiroz,[1] the equipment is adjusted to the average height of the working population in a factory context, which is mostly male. This factor contributes to the development of WMSDs over time, and these pathologies do not develop immediately. They occur due to the musculoskeletal imbalance that the job requires, in which, as a rule, the body recovery time is not enough.[1–3] Consequently, the results of the control group are in line with expectations, since the perception of pain in all evaluated segments increases. The values of the intervention group contrast with the previous ones, since the perception of pain decreases in all segments, with the exception of the elbow. Due to the evolutionary processes of WMSDSs, it can be assumed that this structure is in a more critical state than the others, and therefore the recovery process is more complicated.[22] Ascenção[32] states that pain reduces the muscle’s ability to produce muscle strength. Thus, since the intervention group showed greater strength gains and less pain perception than the control group, the results of this study are similar to the information from the aforementioned study.

In terms of functionality, it is possible to observe that the control group presents a worsening in the data of this variable. This worsening can be explained by the evolution of the lesions over time, since Walsh[33] refers that the evolution process of the lesion leads to the loss of functionality. The same author also states that his results do not prove the relationship between low functionality and increased pain. This is not in agreement with the results found, since the increase in functionality follows the decrease in pain perception in the intervention group. Duarte[5] states that the use of orthosis increases the stability of the joint, as well as the re-education of the correct movement pattern. This re-education allows a movement performed safely, thus increasing functionality and reducing the painful symptoms of injuries.

Regarding the satisfaction/perception questionnaire, contrary to what is described about neoprene orthosis,[5] the temperature felt in the hand is pointed out by the participants in the intervention group as the biggest disadvantage in the use of orthosis. The thickness of the orthosis of 5.5 mm was also a disadvantage, as it conditioned the participants’ movements too much, as well as the fact that the participants’ workstations require meticulous movements and the orthosis, despite being elastic, alters some movement patterns. This factor also goes against what is described in the literature,[5] since a thickness of 5.5 mm is indicated for the structure of the wrist. Dermatological complications also present a difficulty in the use of orthosis by the intervention group. These complications arose from time to time and are in line with what is found in the literature, where some similar cases are reported.[34]

The intervention group used orthosis an average of two mornings per week, which is considered a low rate of use. Despite this, the use of these seems to have a positive impact on the variables studied, even if used for a few period. It was not found in the literature, the average time of use recommended for the use of orthosis in the work context. Despite this, it is known that the most favorable time for the development of WMSDs involves the initial phase of the work, since the body structures are not yet prepared, at the muscular and joint level, for the activity.[35] Thus, the use of orthosis in this period, as suggested to workers, becomes relevant since it conditions the movement patterns harmful to body structures in this crucial period.[5]

Conclusion

The intervention, with neoprene orthosis and therapeutic education, seems to have a positive impact, in the intervention group, in terms of pain perception, muscle strength, protective sensitivity and upper limb functionality.

Despite the results obtained, it is not possible to generalize them due to the sample size used, as well as the time of use of the orthosis. Another limitation of this study, is the fact that the participants did not have an established medical diagnosis.

No literature was found to prove the effectiveness of intervention with neoprene orthosis in WMSDs. In this way, it is proposed that future studies be carried out on this topic, since after 3 months of using the orthosis, one can infer the high potential of their use in the work context. It is recommended that the sample evaluated be larger and that the thickness of the orthosis be smaller, in order to reduce the temperature of the hand, facilitate the execution of the work task, and consequently, increase the consistency of its use by the participants.

Conflitos de Interesse: Os autores declaram a inexistência de conflitos de interesse na realização do presente trabalho. Fontes de Financiamento: Não existiram fontes externas de financiamento para a realização deste artigo. Confidencialidade dos Dados: Os autores declaram ter seguido os protocolos da sua instituição acerca da publicação dos dados de doentes. Proteção de Pessoas e Animais: Os autores declaram que os procedimentos seguidos estavam de acordo com os regulamentos estabelecidos pela Comissão de Ética responsável e de acordo com a Declaração de Helsínquia revista em 2013 e da Associação Médica Mundial. Proveniência e Revisão por Pares: Não comissionado; revisão externa por pares.

Conflicts of Interest: The authors have no conflicts of interest to declare. Financing Support: This work has not received any contribution, grant or scholarship Confidentiality of Data: The authors declare that they have followed the protocols of their work center on the publication of data from patients. Protection of Human and Animal Subjects: The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki as revised in 2013). Provenance and Peer Review: Not commissioned; externally peer reviewed.

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