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Influence of a repetitive strain injuries and musculoskeletal disorders preventive program on surgeons - A Randomized Clinical Trial

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ABSTRACT:Introduction: Repetitive strain injuries and musculoskeletal disorders (RSI/WMSD) affect many workers, including those working in the healthcare area, particularly medical surgeons. Many surgeons suffer from fatigue and musculoskeletal pain after performing a surgery, which impairs the quality of life of these professionals. Thus, it is important to develop RSI/WMSD occupational risk prevention strategies for this population.**Objectives:**To assess the influence of a RSI/WMSD preventive program towards quality of life, muscle strength, flexibility, and intensity of musculoskeletal pain in surgeons at a university public hospital.
Methodology: Randomized clinical trial with a sample comprising 54 surgeons, divided into two groups: A (participated in eight meetings comprising physical exercises and guidance on RSI/WMSD prevention in daily activities, especially work-related ones) and B (received a manual containing information on general health care).**Results:**Both groups showed improvement in quality of life and in the Physical Functioning, Vitality, and Social Aspects domains. In the Pain domain, only group A showed improvement. Both groups showed increased handgrip strength in the left hand and lateral pinch strength in the right hand. Both groups showed decreased intensity of pain in both legs, but only group A showed reductions in shoulder, middle back, lower back, and right hand pain. **Conclusions:** The program was effective in terms of quality of life, strength, and intensity of pain. The program was not effective in increasing the flexibility of lower limbs.
Keywords: Surgeons, Cumulative Trauma Disorders, Quality of life.

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I. INTRODUCTION

Repetitive strain injuries and musculoskeletal disorders (RSI/WMSD) are characterized by inflammation of the muscles, tendons, fascia, and nerves of the upper limbs, shoulder girdle, and neck. Their incidence is increasing and there is evidence of their association with work pace. These diseases account for a significant portion of the reasons for decreased work performance.[1] As with RSI/WMSD, another major public health problem is back pain[2], which can lead to limitations in work activities, generate financial losses[3], and also negatively influence the quality of life of people suffering such a disorder.[4] These diseases affect many workers, including workers in the health area.[5]

Surgeons are examples of health professionals affected by these disorders. Some studies indicate that many surgeons suffer from fatigue and musculoskeletal pain after performing a surgery, particularly laparoscopy. This is due to the unfavorable ergonomic conditions of the operating room and to the body positions adopted while performing surgery. Among the most common positions adopted by surgeons are static neck and trunk positions adopted for long periods of time, interrupted only by small gaps to exchange surgical instruments.[6,7]

Regarding the quality of life of physicians, a study done through the SF-36, on clinicians and surgeons hired and teaching at a university hospital pointed out that clinicians had some impaired domains, particularly "vitality" and "mental

health," and surgeons had "vitality" and "pain" domains affected. Physicians should be evaluated and observed as healthcare workers undergoing work overload and high workload. The development of preventive strategies and the awareness that these workers are also subject to occupational hazards and affected quality of life are important matters.[8]

One way to decrease the discomfort caused by work overload is prevention through physical training. A study showed the effect of a program for training of trunk muscle resistance for medical students performing a laparoscopy. The study showed that the group that went through physical training had decreased perception of discomfort and fewer errors during the execution of the laparoscopy compared with the group that did not undergo physical training.[9]

The aim of the present study was to assess the effect of a repetitive strain injury/work-related musculoskeletal disorder (RSI/WMSD) prevention program (education and exercise) on the quality of life of surgeons in a public teaching hospital. The secondary objectives were to evaluate the effect of this program on intensity and frequency of musculoskeletal pain, muscle strength, and muscular-articular flexibility.

II. METHODS

The study was approved by Research Ethics Committee of the Hospital de Clínicas de Porto Alegre (HCPA), under protocol number 11-0432. Individuals who agreed to join the study received an informed consentwith information about the research and authorization for use of the data obtained through it.

Study Layout and Samples

This was a clinical trial with random selection (Clinical Trials Registration Number: 02552680).

The sampling utilized to select the surgery teams that were invited to participate in the study was not intended to be probabilistic.

Participants were surgeons (university professors, hired physicians, and resident physicians) of the General Hospital of Porto Alegre, of both genders, and members of the general surgery, digestive surgery, plastic surgery, and coloproctology teams. The study excluded individuals who did not agree to participate in it, those who were not present at the time of the study (regardless of reason), and those who had more serious illnesses that prevented the compliance with the study protocols.Data were collected between January 2013 and December 2014.

The participants were randomized into two groups (Group A and Group B). Each group received a different type of intervention.

The members of Group A participated in eight 15-minute long meetings supervised and guided by physical education professionals and held individually twice a week, during the surgeons' working hours, at times and places agreed upon with them. The meetings comprised physical exercises for reinforcement, mobility, and muscle stretching, based on the protocols "Exercises for Chronic Column Pain" and "Exercises for Work-Related Musculoskeletal Disorders" of HCPA's Physical Medicine and Rehabilitation Service. Guidance was also provided on care and prevention of RSI/WMSD in Activities of Daily Living (ADL), especially those related to work activities.

Members of Group B received a manual (brochure) containing information on general health care, especially designed for this study. It included guidance on eating, sleeping, general physical activity, and smoking.

Interventions were standardized through training and supervised by the main author.**Variables and Data Collection Instruments**

The following were the variables for the study: quality of life, musculoskeletal pain, muscle strength, and muscular-articular flexibility. Data collection instruments were applied at three different time points: at the beginning of the program; four weeks after the end of the program; and 26 weeks after the end of the program.

The following data collection instruments were used:

-The Medical Outcomes Study 36-Item Short-Form Survey (SF-36). This is a questionnaire with 36 items measuring eight domains (variables): physical functioning; bodily pain; general health; vitality; physical aspects; social aspects; emotional aspects; and mental health. The highest score for each SF-36 domain is 100 and the lowest is 0.[10,11]

-Map of Body Regions and Diagram of Discomfort/Pain adapted from Corlett and Bishop. This instrument is used to assess subjective feelings of discomfort and pain. The diagram consists of a map of body regions, divided into segments, with a range over which the individual must check the intensity of pain and discomfort.[12]

-Physical Assessment: a) handgrip strength: muscle strength measured through hand dynamometry of the muscles responsible for handgrip motion. Both hands are measured upon three movements and the highest value achieved in each hand is considered.[13]b) Pinch strength: tip pinch: made between the fingertips of the thumb and forefinger; tripod pinch: made between the fingertips of the thumb, index, and middle fingers, andlateral pinch/key pinch: made between the fingertip of the thumb and the lateroradial face of the second phalanx of the forefinger.[14] c) "Sit and

Reach" flexibility test: Wells bench: Individuals in sitting position with legs extended and requested to move a marker on a millimeter surface (Wells bench). Movement is performed three times and the highest value is considered.[13]

In order to collect personal and employment information, a questionnaire on sociodemographic factors was used.[15]

Calculation of sample size

Considering a significance level of 5%, with an 80% probability of detection of a difference of 15 points[16] in SF-36 score in the "vitality" domain (standard deviation of 17)[8], the study required at least 22 participants in each group (total n=44). Considering the risk of loss as a result of the research, 20% was added to the total number of participants, resulting in a sample of n=54 (27 participants per group).

Data collection

Randomization

The method used to generate the random allocation sequence was a list of random numbers. A list from 1 to 54, with its respective groups A and B, was generated in SPSS 18.0 (Chicago, USA). Then an independent, blinded researcher placed cards with the letters "A" or "B" in envelopes, according to the list generated previously. The envelopes were sealed and simple randomization occurred when the participants took the envelopes at the time of randomization.

Blinding

Blinding in relation to the interventions of the researcher who organized the randomization and of the evaluator.

Statistical Analysis

The collected data were analyzed using the statistical software (PASW version 18.0 from IBM Company).

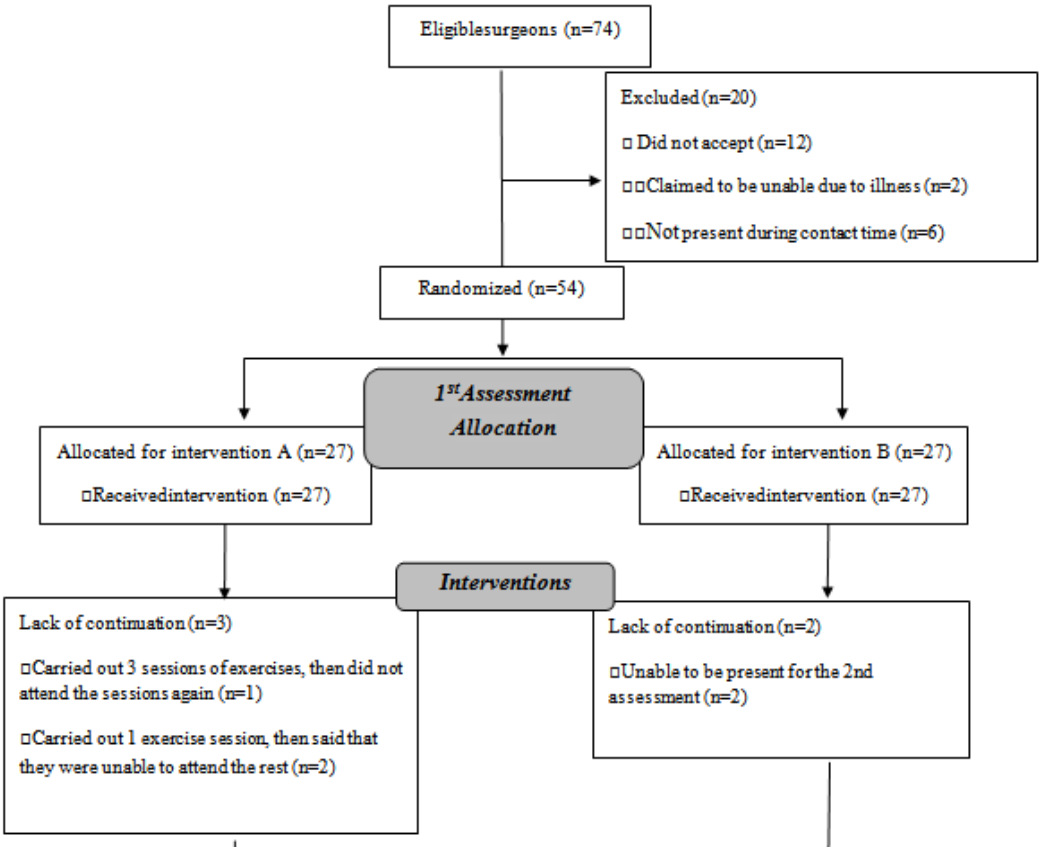
Initially, a data frequency analysis was made through Kruskal-Wallis (representation by quartiles) and Chi-square (representation by 'n' absolute frequencies and '%' relative frequencies) tests.

We used the GEE Model, using the normal or gamma distribution, depending on the results of the normality test. A covariance matrix of robust estimator and a correlation matrix of unstructured work were used. The model was composed of time, group and interaction (time* group). The post-hoc test used was the Bonferroni.

The significance level adopted was 0.05.

III. RESULTS

Figure 1 shows the study flowchart.



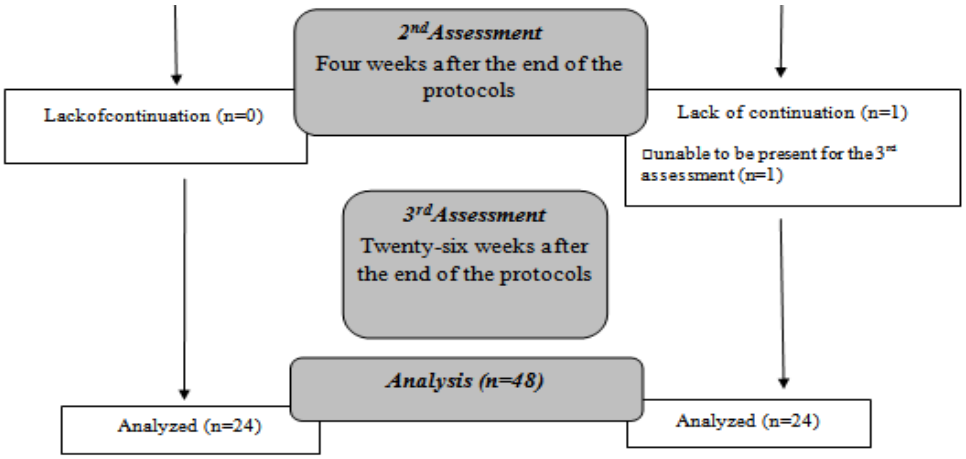


Figure 1. Study flowchart

Fifty-four surgeons were assessed at the beginning of the study. Of these, 74% (n=40) were male, 3.7% (n=2) were university professors, 38.9% (n=21) were hired physicians and 57.4% physicians (n=31) were resident physicians. Among the assessed individuals, 61% (n=33) claimed not to do any physical exercise.

According to the analysis of sociodemographic variables (gender, age, physical exercise practice, and professional data), it was observed that the groups had no significant difference between them (Table 1).

TABLE 1
Base Sociodemographic Data of the Sample

	Group A (n=27)	Group B (n=27)	P value
Gender[1]			0.756
Male	21 (77.8)	19 (70.4)	
Female	06 (22.2)	08 (29.6)	
Age (years)[2]	33 (26 - 43)	29 (26 - 38)	0.532
Physical exercises practice[1]			0.264
No	19 (70.4)	14 (51.9)	
Yes	8 (29.6)	13 (48.1)	
Title at HCPA Institution[1]			0.239
Professor	2 (7.4)	0 (0)	
Hired	12 (44.4)	9 (33.3)	
Resident	13 (48.1)	18 (66.7)	
Surgical sector at HCPA Institution[1]			0.326
General Surgery	16 (59.3)	19 (70.4)	
Digestive Surgery	4 (14.8)	6 (22.2)	
Coloproctology	3 (11.1)	1 (3.7)	
Plastic Surgery	4 (14.8)	1 (3.7)	
Professional working time (years)[2]	9.2 (1.2–18.3)	9,2 (1.2-15.1)	0.710
Working time at HCPA Institution (years)[2]	1.9 (0.9–11.0)	2 (1.0–6.2)	0.883
Total weekly workload, including HCPA and other possible Institutions (hours)[2]	60 (55-90)	60 (60-80)	0.653
Number of total weekly surgical procedures[2]	6 (4–8)	6 (4–8)	0.993

[1]Representation per n (%)
[2]Representation per mean (inter-quartile 25 – 75)

TABLE 2
Comparison of Means of Variables Related to the SF-36 Test

Variables	Groups	Time 1	Time 2	Time 3	Total	$p_{interaction}$	p_{group}	p_{time}
		mean	mean	mean	mean			
SF36Total[1]	GA	122	127	128	126	0.68	0.72	≤ 0.001*
	GB	123	125	127	125			
	Total	123_a	126_{bc}	127_c				
Physical Functioning[2]	GA	89.1	90.9	91.8	91.1	0.29	0.27	0.0489*
	GB	93.7	91.8	93.7	93.6			
	Total	91.9_a	91.7_a	93.6_b				
Physical Aspects[2]	GA	90.7	90.8	96.7	92.7	0.36	0.79	0.47
	GB	94.4	88.2	92.9	91.8			
	Total	92.6	89.5	94.8				
Pain[2]	GA	66.9_{Aa}	71.9_{ab}	76.8_b	71.8	0.0178*	0.45	0.10
	GB	74.7_B	76.1	72.8	74.5			
	Total	70.7	74.0	74.8				
General Status	GA	75.7	76.8	77.7	76.7	0.85	0.13	0.19
	GB	79.9	82.7	84.0	82.2			
	Total	77.8	79.7	80.8				
Vitality[2]	GA	57.4	66.1	67.4	63.5	0.12	0.51	≤ 0.001*
	GB	57.2	59.2	66.4	60.8			
	Total	57.3_a	62.6_b	66.9_c				
Social Aspects[2]	GA	75.5	84.5	91.4	83.5	0.52	0.59	0.0006*
	GB	75.5	83.3	85.0	81.2			
	Total	75.5_a	83.9_b	88.1_b				
Emotional Aspects[2]	GA	98.5	95.8	90.8	95.0	0.34	0.76	0.26
	GB	93.1	97.4	91.9	94.1			
	Total	95.8	96.6	91.3				
Mental Health[2]	GA	80.6	81.7	83.4	81.9	0.90	0.07	0.06
	GB	74.8	77.0	78.6	76.8			
	Total	77.6	79.3	80.9				

*Statistically significant difference
[1]Normal Distribution
[2]Gamma Distribution
[a,b,c]Represent statistically different time means, defining the group
[A,B,C]Represent statistically different group means, defining the time

TABLE 3
Comparison of Variable Means Related to Strength and Flexibility Tests

Variables	Groups	Time 1 mean	Time 2 mean	Time 3 mean	Total Mean	$p_{interaction}$	p_{group}	p_{time}
Handgrip Strength in Right Hand[2,3]	GA	43.3	43.2	43.9	43.5	0.44	0.65	0.67
	GB	41.7	42.8	41.5	41.9			
	Total	42.5	42.9	42.7				
Handgrip Strength in Left Hand[2,3]	GA	39.2	39.8	41.8	40.2	0.15	0.45	0.0293*
	GB	37.2	38.9	38.1	38.0			
	Total	38.2_a	39.3_b	39.9_{ab}				
Pinch Strength Between Fingertips of the Right Hand[1,3]	GA	6.58	6.65	6.45	6.56	0.35	0.83	0.69
	GB	6.47	6.61	6.85	6.64			
	Total	6.52	6.63	6.65				
Pinch Strength Between Fingertips of the Left Hand[2,3]	GA	6.11	6.05	5.97	6.05	0.96	0.76	0.70
	GB	6.20	6.16	6.13	6.16			
	Total	6.16	6.10	6.05				
Tripod Pinch Strength in the Right Hand[2,3]	GA	7.70	8.27	8.27	8.08	0.41	0.48	0.11
	GB	8.26	8.36	8.69	8.43			
	Total	7.97	8.32	8.47				
Tripod Pinch Strength in the Left Hand[1,3]	GA	7.08	7.51	7.68	7.42	0.18	0.25	0.17
	GB	7.85	7.79	8.17	7.94			
	Total	7.47	7.65	7.92				
Lateral Pinch Strength in the Right Hand[1,3]	GA	9.29	9.87	9.63	9.59	0.19	0.99	0.002*
	GB	9.54	9.73	9.47	9.58			
	Total	9.41_a	9.80_b	9.55_{ab}				
Lateral Pinch Strength in the Left Hand[2]	GA	8.75	9.19	8.89	8.95	0.52	0.68	0.06
	GB	8.68	8.81	8.69	8.73			
	Total	8.72	8.99	8.79				
Wells Bench Test[2,4]	GA	19.4	21.3	21.2	20.6	0.16	0.23	0.08
	GB	22.9	25.2	22.9	23.6			
	Total	21.1	23.1	22.1				

*Statistically significant difference
[1]Normal Distribution
[2]Gamma Distribution
[3]Unit in kgf
[4]Unit in cm
[a,b,c]Represent statistically different time means, defining the group

TABLE 4

Comparison of Means of Variables Related to the Map of Body Regions and Diagram of Discomfort/Pain, Adapted From Corlett and Bishop

Variables	Groups	Time 1 mean	Time 2 mean	Time 3 mean	Total mean	$p_{interaction}$	p_{group}	p_{time}
Neck[2]	GA	13.1	7.29	6.42	8.50	0.47	0.72	0.42
	GB	6.61	5.23	9.09	6.80			
	Total	9.31	6.18	7.64				
Cervical Region[2]	GA	10.3	7.10	5.76	7.50	0.11	0.75	0.81
	GB	3.86	5.81	10.7	6.22			
	Total	6.31	6.42	7.87				
Left Shoulder[2]	GA	5.01_{A}	7.95_{A}	3.97_{A}	5.41	0.0164*	0.12	0.51
	GB	1.88_{Aa}	1.75_{Ba}	4.4_{Ab}	2.44			
	Total	3.07	3.74	4.18				
Right Shoulder[2]	GA	7.12_{a}	4.90_{ab}	2.53_{b}	4.45	0.0219*	0.90	0.99
	GB	2.57_{a}	3.81_{ab}	7.38_{b}	4.17			
	Total	4.28	4.32	4.32				
Left Arm[2]	GA	w/e	1.26	w/e	2.15	0.13	0.18	0.28
	GB	1.16	1.12	1.49	1.25			
	Total	1.08	1.19	1.22				
Upper Back[2]	GA	6.73	5.43	3.49	5.04	0.19	0.21	0.94
	GB	1.98	2.78	3.55	2.69			
	Total	3.65	3.89	3.52				
Left Arm[2]	GA	w/e	1.23	w/e	1.07	0.07	0.05	0.12
	GB	1.16	1.17	1.94	1.38			
	Total	1.08	1.20	1.39				
Middle Back[2]	GA	8.41_{aA}	2.37_{b}	1.96_{b}	3.39	0.0009*	0.81	0.70
	GB	1.71_{aB}	3.88_{b}	4.15_{ab}	3.02			
	Total	3.79	3.03	2.85				
Lower Back[2]	GA	18.31_{aA}	4.86_{b}	2.56_{c}	6.11	0.0007*	0.69	0.0202*
	GB	3.79_{B}	4.19	6.8	4.77			
	Total	8.33	4.51	4.19				
Pelvis	GA	3.39	2.11	2.48	2.61	0.73	0.09	0.18
	GB	1.32	1.03	1.66	1.31			
	Total	2.12	1.47	2.03				
Left Elbow[2]	GA	1.16	1.13	1.12	1.13	0.70	0.25	0.32
	GB	1.34	1.29	1.57	1.39			
	Total	1.25	1.21	1.32				
Right Elbow[2]	GA	1.02	0.99	1.11	1.04	0.29	0.19	0.16
	GB	1.02	1.31	2.03	1.47			
	Total	1.11	1.14	1.49				
Left Forearm[2]	GA	1.02	1.38	1.00	1.11	0.27	0.39	0.57
	GB	1.22	1.17	1.34	1.24			
	Total	1.12	1.25	1.16				
Right Forearm[2]	GA	1.08	1.33	0.99	1.13	0.08	0.25	0.44
	GB	1.18	1.10	1.98	1.37			
	Total	1.13	1.21	1.40				

Variables	Groups	Time 1 mean	Time 2 mean	Time 3 mean	Total mean	$p_{interaction}$	p_{group}	p_{time}
Left Wrist[2]	GA	2.22	1.74	1.75	1.89	0.16	0.77	0.31
	GB	1.45	1.49	2.17	1.67			
	Total	1.79	1.61	1.95				
Right Wrist[2]	GA	2.48	2.13	2.05	2.21	0.38	0.64	0.69
	GB	1.47	1.61	2.30	1.76			
	Total	1.91	1.85	2.17				

Left Hand[2]	GA	2.26	1.73	1.78	1.91	0.27	0.47	0.67
	GB	1.27	1.28	1.64	1.39			
	Total	1.69	1.49	1.71				
Right Hand[2]	GA	3.04_{aA}	1.82_{b}	1.79_{b}	2.15	0.0143*	0.39	0.59
	GB	1.22_{B}	1.47	1.72	1.46			
	Total	1.93	1.64	1.76				
Left Thigh[2]	GA	1.34	1.18	1.00	1.17	0.29	0.34	0.16
	GB	1.84	1.17	1.53	1.49			
	Total	1.57	1.17	1.24				
Right Thigh[2]	GA	1.29	1.40	1.01	1.22	0.25	0.33	0.22
	GB	2.22	1.23	1.54	1.61			
	Total	1.69	1.31	1.25				
Left Knee[2]	GA	2.72	2.03	2.86	2.51	0.37	0.49	0.48
	GB	1.71	1.83	2.02	1.85			
	Total	2.16	1.92	2.40				
Right Knee[2]	GA	3.15	2.23	4.28	3.11	0.29	0.29	0.25
	GB	1.74	1.87	2.08	1.89			
	Total	2.34	2.04	2.99				
Left Leg	GA	2.77	1.22	1.48	1.71	0.78	0.67	0.0382*
	GB	1.98	1.20	1.42	1.50			
	Total	2.34_{A}	1.21_{B}	1.45_{B}				
Right Leg[2]	GA	4.32	1.18	1.58	2.01	0.44	0.32	0.0145*
	GB	1.91	1.14	1.38	1.44			
	Total	2.87_{a}	1.16_{b}	1.48_{b}				
Left Ankle[2]	GA	1.09	1.15	1.16	1.14	0.57	0.11	0.38
	GB	1.22	1.82	1.80	1.59			
	Total	1.16	1.45	1.44				
Right Ankle[2]	GA	1.09	1.18	1.13	1.13	0.30	0.19	0.15
	GB	1.08	1.65	1.83	1.48			
	Total	1.09	1.39	1.44				
Left Foot[2]	GA	2.62	1.49	1.67	1.87	0.15	0.71	0.83
	GB	1.77	2.55	2.18	2.14			
	Total	2.16	1.95	1.91				
Right Foot[2]	GA	2.26	1.56	1.40	1.70	0.12	0.51	0.77
	GB	1.81	2.45	2.29	2.17			
	Total	2.02	1.96	1.79				

*Statistically significant difference
[2]Gamma Distribution
[a,b,c]Represent statistically different time means, defining the group
[A,B,C]Represent statistically different group means, defining the time
w/e without estimate

IV. DISCUSSION

The present study was one of the few that have addressed intervention with surgeons through a protocol with physical exercises done in the work environment and supervised by a physical education professional, and is the only study of this subject using a randomized clinical trial.

The educational program protocol consisted of physical exercises and educational guidance on postural care and prevention of musculoskeletal pain. It was created specifically for this intervention, was effective, and showed good adherence by the surgeons in the institution in which this study was carried out. There was an 11% (n=6) drop-off rate. The fact that this protocol consisted of short physical exercise sessions that could be done without special clothing and equipment and in places with little space facilitated its application.

Although surgeons are constantly exposed to risk factors involving ergonomics, posture, and repetitive movements that could cause the development of diseases related to the musculoskeletal system, the majority of available studies are cross-evaluations of these factors utilizing prevalence studies and ergonomic analysis of work stations, particularly in surgical environments. However, these studies have not carried out longitudinal follow-up with assessment

of the effectiveness of intervention measures to minimize these risk factors.

Postural guidance, along with stretching exercises and muscle strengthening in the shoulder and spine regions, are very important. Surgeons have to adopt static positions for long periods during surgical procedures, such as laparoscopy and open surgeries.[6]Maintaining these postures may lead to muscle fatigue and symptoms such as pain and discomfort. Furthermore, since the movements and positions commonly adopted are those of rotation and flexion of the trunk and neck[7], it is important to highlight that these positions and movements are the ones that cause most damage to the intervertebral discs of the cervical and lumbar regions. These types of repetitions and postures can encourage the emergence of diseases of the spine. This is evidenced in studies that have report that the main complaints of pain and discomfort among surgeons are those that affect the neck, shoulders and lower back.[17,18]

Since the prevalence of painful musculoskeletal symptoms among this population reaches around 81.5%, and (as noted above) the most prevalent musculoskeletal symptoms are muscle contracture, neck pain, back pain, and even arthritis and bursitis in the shoulder region, specific measures for these body regions are important.

Another region that is very much affected among surgeons is the hands and wrists. One study pointed out that surgical practice time was associated with the emergence of carpal tunnel syndrome in these professionals.[19] Another study found that the occurrence of symptoms was usually higher in the dominant hand.[20] These observations should be analyzed in order to encourage the adoption of improved care among surgeons as soon as possible, in order to avoid symptoms that may appear over the course of their practice.

Another study showed that many of the surgeons who were assessed said they were under high pressure, experienced physical exhaustion at the end of the day, and had working conditions that contributed to the onset or progression of symptoms.[21] In addition to poor posture and stressful environments, other influencing factors were long working hours, age and gender. Older professionals and female professionals reported a higher prevalence of musculoskeletal disorders.[22] However, the study pointed out that resident physicians were also exposed to routines that could lead to fatigue, depression, and stress, leading to losses in quality of life in this population.[23]

Regarding length of time in the profession, another study found that finger pain was more common in beginners, while more experienced endoscopists were more affected by shoulder pain. In addition, 60% of the symptomatic physicians had to change their practices or reduce the number of endoscopic examinations, but only a small percentage of these individuals requested consultation with a specialist to deal with these conditions.[24]

Regarding quality of life, one study pointed out that surgeons had lower scores on the vitality domain of the Short Form Health Survey (SF-36) when compared to clinicians.[8] Although the technical literature points out an association between low scores on this instrument and low quality of life among surgeons, this study showed high scores for the domains of the SF-36, particularly the domains physical capacity, physical aspects, general state of health, emotional aspects, and mental health, with means above 75 on these areas. However, scores on the pain and vitality domains were lower when compared to the scores mentioned above, especially the pain domain. This item reflects the importance of work programs and interventions in order to ensure that pain does not interfere with the routine of surgeons. And in the present study, the item regarding pain was statistically different in the group that received intervention with physical exercises and posture guidelines.

The technical literature presents some intervention studies with surgeons in order to evaluate the health promotion actions of these professionals. Training consisting of physical exercises to strengthen abdominal and trunk muscles was shown to be effective in reducing fatigue and discomfort in laparoscopic simulation tests carried out with students.[9] The results of this longitudinal study showed that the training was beneficial in the reduction of musculoskeletal symptoms among the surgeons assessed.

Another intervention that was shown to be effective in decreasing discomfort and muscle fatigue in surgeons was the adoption of 20-second breaks for stretching the upper limbs every 20 minutes during surgery. These stretching activities were carried out in the operating room. In addition to reduction of discomfort and fatigue, the results showed greater accuracy on error simulation equipment when adopting breaks compared to non-adoption.[25] Therefore, this presented important data for the application of a simple protocol of physical exercises that was shown to be very effective by the results of the data analysis.

The results of the present study were satisfactory, especially with respect to musculoskeletal pain. Although the protocol was only 8 sessions of exercises with posture guidance in work activities, both short-term and long-term effects were observed. Similar results have been observed in studies that used back school or postural school programs. These programs have different application models, but for the most part, they are physical exercise programs and offer

theoretical guidance on being careful with posture and the spinal column for individuals with back pain. This suggests that health programs that combine physical exercises and care guidelines for posture and work are beneficial in terms of reducing symptoms and intensity of musculoskeletal pain.[26,27,28]

It is important to carry out more studies with this model in order to establish physical exercise protocols and routines and educational activities and improve aspects related to musculoskeletal symptoms and quality of life in this segment of workers.

The present study had some limitations. It did not address differences between university professors, staff surgeons and residents; the routines of these three categories of professionals are different and there may be differences between these groups. However, in the analysis of the study in question, the proportions of these categories were kept in the sample.

The data obtained in this study should be analyzed with caution, as the sample consisted of surgeons from four surgical teams at a teaching hospital.

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The authors declare there are no conflicts of interest.

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