

Evaluation of the Musculoskeletal System of Patients in Cardiopulmonary and Metabolic Rehabilitation Programs

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Abstract

Background: Participants of cardiopulmonary and metabolic rehabilitation (CPMR) programs may present with musculoskeletal changes that may affect treatment compliance and effectiveness.

Objective: To develop an instrument for evaluation of the musculoskeletal system and identification of problems, especially those related to exercise, so that patients can be cleared to exercise with no restrictions, cleared with restrictions, or not cleared before approval from a specialist.

Methods: Construction and validation (according to Cronbach's alpha) of a musculoskeletal system assessment inventory (MSSAI), for subsequent administration to participants in CPMR programs.

Results: A total of 103 individuals participating in CPMR programs were evaluated by means of the MSSAI, whose internal validity and reliability proved to be satisfactory. Of these, 33 were men (32%) and 70 were women (68%), with age ranging from 36 to 84 years; 47 (45.6%) had already been diagnosed with musculoskeletal system disorders; 39 (37.9%) had already received specific treatment for the musculoskeletal system; 33 (32%) used to take medications to relieve symptoms related to the musculoskeletal system; and 10 (9.7%) had a medical restriction for performing some type of exercise. We should point out that 48 individuals (46.6%) reported pain in the musculoskeletal system; in 14 (13.6%) of them, the pain worsened by exercise, and this should have prevented them from participating in exercise programs before receiving approval from a specialist.

Conclusion: The MSSAI, whose internal validity and reliability proved satisfactory, showed that there was some restriction to exercise practice for almost half of the individuals participating in CPMR programs, and that some of them should not have been cleared without approval from a specialist. (*Arq Bras Cardiol* 2010; 95(2): 258-263)

Key words: Locomotion; patients; exercise; coronary diseases; hypertension; diabetes mellitus.

Introduction

Cardiopulmonary and metabolic rehabilitation (CPMR) programs are designed to treat individuals with hypertension; coronary artery disease; heart failure; peripheral obstructive arterial disease; chronic obstructive pulmonary disease; diabetes; and others, with emphasis on physical exercises which should be considered a priority in therapeutic regimens for these patients¹⁻⁷. It is presumed that a significant part of these patients also show degenerative changes of the musculoskeletal system, partly resulting from the aging process^{8,9}. These changes should be detected prior to the individual's admission to the programs. Other subsequent assessments are also recommended, with the objective of preventing the musculoskeletal system disorders from

aggravating, thus increasing treatment compliance and improving its results¹⁰⁻¹².

An interesting means of detecting musculoskeletal system disorders may be by investigating pain¹⁰⁻¹², which is defined by the International Association for the Study of Pain (IASP) as an unpleasant subjective sensory and emotional experience associated with actual or potential tissue damage^{13,14}. Pain may be seen as a multidimensional phenomenon involving physiological, sensory, affective, cognitive, behavioral, social and cultural aspects^{15,16}. It may be influenced by memory, expectations and emotions, in addition to factors such as socioeconomic conditions; cultural context; history of diseases; coping strategies; and more. Precisely because it is an experience that encompasses a variety of domains, measuring pain becomes a broad and complex process^{16,17}. Its assessment should include, as much as possible, all of these dimensions. For this purpose, one-dimensional instruments were developed that measure one single dimension of pain, and multidimensional instruments that provide a more encompassing evaluation which are presumably less biased, thus providing a better representation of reality^{16,17}.

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In the literature, a set of measurements and tests used to evaluate pain are reported; however, we did not find any instrument developed with the purpose of identifying pain in individuals engaging and participating in CPMR programs^{1-7,9}.

The objective of this study was to develop an instrument for the assessment of the musculoskeletal system for individuals participating in CPMR programs in order to identify problems, especially those related to exercise, aiming at the patient's screening, i.e., their being cleared to exercise with no restrictions, with restrictions, or not being cleared before approval from a specialist.

Methods

Research planning and development

In order to develop the assessment instrument, the PAR-Q¹⁸ was considered, however with a more restricted objective, namely the investigation of the existence of musculoskeletal system disorders in the population participating in CPMR programs. The instrument, which we called musculoskeletal system assessment inventory (MSSAI) consists of two parts: the first one with questions with dichotomous answers, and the second one with the purpose of having the responder mark the local and intensity of an occasional pain worsened by physical exercise.

For the development of the MSSAI, six phases were observed: definition of the study object; design of the attributes of the study object; verification of components and dimensions; definition of the theoretical construct of the study; creation of rules and criteria to construct the items; and theoretical analysis of the items.

According to the method proposed by Pasquali¹⁹, the first version of the MSSAI was initially presented to five expert judges for the process of construct analysis and clarity, which implied checking for consistency and adequacy of the items. The judges' task was to classify the MSSAI items in three dimensions, according to their clarity: 1. unclear/confusing, 2. not quite clear, and 3. clear. After the judges' assessment, their considerations were accepted and the instrument then underwent a first reformulation. Next, the MSSAI was presented to 20 patients participating in CPMR programs, including the highest and lowest levels of education for semantic analysis, i.e., to test for clarity of the items. This first semantic analysis showed whether the items would be understood by the target population of the inventory.

A pilot study was then carried out by assessing 20 patients engaged in CPMR programs, in order to test the MSSAI one more time. Only one of the patients failed to answer all the questions and was therefore excluded from the process. At this point, it was verified that a minor restructuring was necessary. After this procedure, the study was submitted to a second semantic analysis by seven patients. Later, 103 participants of the CPMR program were assessed by means of the MSSAI.

Considering the theoretical information available in the literature and the empirical experience, items could be selected and elaborated that would enable a rapid assessment of the musculoskeletal system using the MSSAI as a means of screening, and the dimensions (attributes)

that would be part of the construct were defined. The first part of the MSSAI was formulated with six items in the form of questions with a two-point variation scale (yes or no), according to the dichotomy method¹⁹.

The second part of the MSSAI was developed to verify the intensity and location of pain worsened by exercise, and applied only to individuals fitting this situation. For this purpose, a Likert scale was used, with five possible answers: 1 = mild pain, 2 = moderate pain, 3 = slightly strong pain, 4 = strong pain and, 5 = unbearable pain. The individuals should mark the drawings of the human body (front view and back view) showing the site and a numeric value corresponding to the intensity of the pain felt.

After the different phases and changes, the final MSSAI version contained six items (affirmative sentences) and one illustrative question to be answered only by the individuals whose answer to item 6 was yes, i.e., they had pain worsened by exercise (Box 1).

Ethical aspects of the study

This study was approved by the Research Ethics Committee of *Universidade do Estado de Santa Catarina* (Protocol nº 181/2008), according to Resolution nº 196/96 of the National Health Council for research in humans, based on the 1975 Declaration of Helsinki. The patients gave written informed consent after receiving explanations on the methods and objectives of the study.

Statistical analysis

In the present study, of a mixed nature, the analysis comprised different phases. It can be classified as a quantitative descriptive study, for describing and quantifying the instrument developed. The study can also be seen as a development research because, according to Contandriopoulos et al, its cardinal principle is the development or systematic elaboration of intervention or instrumentation procedures or measurement methods, with the objective of elaborating an instrument for the identification of musculoskeletal system disorders, especially of pain, during the assessment of individuals referred to CPMR programs.

The statistical analysis allowed a descriptive data analysis (mean and standard deviation) for all study variables. In the sequence, the main components of the construct were evaluated, and a factorial analysis was carried out. Then, the reliability coefficient of the scales was calculated using the Cronbach's alpha. The Statistical Package for the Social Sciences (SPSS) 13.0 software program for Windows was used for the statistical analysis. The 95% confidence interval was adopted for all analyses, and the significance level was set at $p < 0.05$.

Results

Clarity of the items was initially assessed by five judges, whose task was to classify the MSSAI items in three dimensions, according to their clarity: 1. unclear / confusing, 2. not quite clear, and 3. clear. Most of the items assessed by the judges showed a concordance of 0.80 for the adequacy criterion.

1st. PART

1. Has any doctor ever told you that you have a bone, muscle or articulation (joint) problem (for instance, in the backbone, knee, hip, shoulder)?

() YES () NO

2. Has any doctor ever recommended a specific treatment for a bone, muscle or articulation (joint) problem to you?

() YES () NO

3. Do you usually take medications for bone, muscle or articulation (joint) problems?

() YES () NO

4. Has any doctor ever told you not to perform any type of physical exercise?

() YES () NO

5. Do you feel any bone, muscle or articulation (joint) pain?

() YES () NO

6. Do you feel any bone, muscle or articulation (joint) pain that worsens with physical exercises?

() YES () NO

** If you marked YES in question 6, please proceed to the next page.

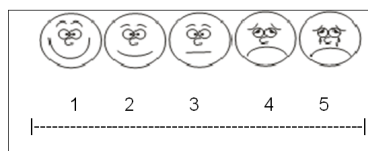
2nd. PART

HISTORY - TAKING FOCUSED ON THE MUSCULOSKELETAL SYSTEM

Below you will find front and back views of drawings of the human body. Please note down your RATE regarding the bone, articulation (joint) or muscle PAIN worsened by physical exercise in the corresponding site.

NOTE: Please consider the following rating scale:

- (1) MILD PAIN
- (2) MODERATE PAIN
- (3) SLIGHTLY STRONG PAIN
- (4) STRONG PAIN
- (5) UNBEARABLE PAIN



Right Left



FRONT

Left Right



BACK

Box 1 - Musculoskeletal system assessment inventory (MSSAI) from Mozerle and Carvalho 2009.

Questions with values lower than 80% were reviewed using the judges' suggestions, which were accepted and incorporated to the construct, even for the questions with high values, i.e., above 80%.

After reformulation of the inventory, it was verified that, in the semantic analysis, the inventory was clear for both levels of the sample assessed. According to the opinion of judges and raters, the instrument was clear to most of the 20 patients who participated in this phase. We should point out that one of the judges was excluded for not answering one of the questions.

In the next phase, the pilot study was administered to 20 participants of the CPMR program, and question 5 ("Do you feel any bone, muscle, or articulation / joint pain that worsens with physical exercises?") was not clear to them. Thus, one

item was added before the fifth item, asking whether the patient felt pain at rest that did not worsen with exercise.

After that, the MSSAI had to be submitted to a second semantic assessment by seven rater patients. In this phase, participants with a lower educational level had difficulty understanding some terms, thus those items were rephrased. The sentence "below, you will find front and back views of drawings of the human body", was added so that the individuals could understand the item more clearly. In the process of semantic analysis, we verified that rephrasing some items was enough to make the participants understand them.

Thus, the MSSAI final version contained six items (affirmative sentences), and question 7, illustrative, was answered only by individuals whose answer to item 6 was yes.

In the last phase of the construction of the inventory, the MSSAI was administered to a group of 103 individuals participating in two CPMR programs, 33 of them men (32%) and 70 women (68%), with ages ranging from 36 to 84 years (mean age of 63 ± 9 years).

Of the 103 individuals assessed, 47 (45.6%) answered that they had been clinically diagnosed with a musculoskeletal system disorder. In relation to item 2, 39 (37.9%) answered that they had been referred for specific treatment (drug therapy, physical therapy or surgery). As regards the use of medications (item 3), 33 (32%) reported that they used them.

In item 4, 10 (9.7%) participants answered that, at a given moment, a physician had told them not to perform some type of physical exercise.

In relation to the presence of pain at rest or when performing a movement (item 5), the answers from 48 participants (46.6%) were positive. For item 6, on whether the pain worsened by physical exercise, the answers from 14 (13.6%) individuals were positive, who pointed out their respective locals of pain as well as their intensity, as shown in detail in Box 2.

In view of the answers given, the validity of the MSSAI was verified using the statistical analysis of the Cronbach's alpha

coefficient, which provided the degree of internal consistency of the items of the rating scale. Alpha values range from 0 to 1; the closer to 1, the higher the correlation of the items set, thus showing the intra-items consistency of one dimension. The values of the six items, as determined after the analysis procedures, were: items 1, 2, 3 and 5 had a Cronbach's alpha reliability coefficient considered satisfactory because they were higher than 0.70 (alpha 0.80), and items 4 and 6 had a moderate alpha (alpha 0.61). Cronbach's alpha values for each MSSAI item are shown in Table 1.

The analysis of the visual identification of pain and its intensity (item 7) in the MSSAI was represented by a body scheme for the participants to point to or mark the site of their pain according to its intensity. Thus, information could be obtained on the site and intensity of pain. Only 14 (13.6%) participants answered question 6 and proceeded to the next item, marking the points corresponding to their pain.

Discussion

Andrade's study²⁰ points out that for constructing instruments, the reliability of dichotomous rating scales is assessed using the Cronbach's alpha index. Results above

Patient	Site	Site		Pain intensity	
		Front	Back	Right	Left
1	Knee	X			2
	Lower back		X	2	
2	Abdomen	X			2
3	Thorax	X		3	
4	Back		X	3	
5	Shoulder	X	X	3	
6	Abdomen	X		2	
	Shoulder		X	2	
7	Shoulder	X		1	
8	Lower back		X		1
9	Shoulder	X	X		2
	Knee	X			2
	Elbow		X	2	
10	Elbow	X			2
	Back		X	2	
11	Knee	X		3	
12	Shoulder	X		2	
	Foot		X	2	
13	Knee	X		3	
	Shoulder	X			2
14	Knee	X		2	

Box 2 - Results of patients who reported pain with physical exercise, site of pain and its intensity.

Table 1 - Cronbach's alpha values for validation of the items

	Cronbach's alpha
Item 1	0.715
Item 2	0.717
Item 3	0.791
Item 5	0.803

0.8 are considered excellent. Based on this, the author mentions that the construction study may give continuity to its structuring. According to Nunnally²¹, Cronbach's alpha values higher than 0.6 may be used in conformity with the item response theory.

In the visual part, in turn, of the patients who identified pain in the drawing of the human body, six pointed to the region of the shoulder. The literature shows that, in the elderly, there is a higher prevalence of low back pain, shoulder pain, and knee pain²²⁻²⁴.

According to Snider²², shoulder pain is more common among individuals over 50 years of age. According to Magee²³, this pain may be caused by an intrinsic disease in this region, a disease in the periarticular structures which tends to have a more significant impact because this site is related to a broader range of motion.

Patients reporting knee pain usually present with instability, stiffness, swelling, locked joint, or debility²².

Only two patients reported low back pain. According to the Medical Multimedia Group²⁴, low back pain affects working-age individuals, 80% of the adults, and a significant part of the episodes tend to become chronic in the elderly.

We should point out that of 48 individuals (46.6%), 14 (13.6%) reported pain that worsened by exercise. This, according to our recommendation, would require the opinion from a specialist for the patient to keep on the exercise program. Therefore, for 46.6% of the individuals, there was some restriction regarding the current pain, and 13.6% who reported pain worsened by exercise should be

removed from the program and resume their participation only after a specialized evaluation occasionally followed by a specific treatment.

These data show the importance of a systematic assessment of the musculoskeletal system in these individuals, with the purpose of increasing the effectiveness of CPMR programs, not only to prevent musculoskeletal system conditions from deteriorating, but also to improve treatment compliance.

Once systematically incorporated to CPMR programs, the MSSAI will contribute to screen patients and thus allow their classification into three categories: a) patients cleared to the CPMR program with no special recommendation (those with no positive answers); b) patients cleared with special recommendations, occasionally with some restrictions (those with positive answer(s), especially in the presence of a current complaint of pain); and c) patients not allowed to participate in the program before approval from a specialist (those with complaint of pain worsened by exercise)⁹.

Conclusions

The MSSAI, whose validity and reliability parameters were satisfactory, showed that practically half of the participants in CPMR programs had some restriction regarding the performance of exercises, and some of them should not have been cleared without approval from a specialist.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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There were no external funding sources for this study.

Study Association

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