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Measuring pain

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Measuring pain

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Abstract. A system of evaluation and quantification of pain in the human body that considers anatomical, physiological, environmental and psychological measurements of the patients is presented. The measured variables are compiled by algorithms that generate a graph where the pain level is presented in a scale from 0 to 10 called the rtz scale. A report with information and images relevant to the decision making of health professionals, reducing the subjectivity of the diagnoses, is generated. The proposed system represents an advance in the measurement of pain in humans and the rtz scale creates reference parameters for its quantification.

1. Introduction

For obvious social and economic reasons, the study of pain is so important that only a few people reach adulthood without major complications caused to them. Pain is the most common complaint in which people seek medical attention. While pain is often only described as a sensation, it is in fact a consequence of many variable stimuli including some that are commonly innocuous or harmless and generally unidentified in current clinical research methods that use stimuli or observation of inflammatory processes.

The International Association for the Study of Pain - IASP defines pain in humans as an unpleasant sensory and emotional experience associated with risk or tissue damage or described based on such harm [1].

The procedure most used in the evaluation of bodily pain as an attempt to determine the individual's ability to perform the requested function is based on subjective medical examination, in which the physician, restricted from his empirical knowledge, obtains an opinion through verbal descriptions or writing and / or behavioural observations, relating the results obtained with the degree and location of pain alleged by the individual in question.

The instruments currently used for pain assessment do not have a measure that allows an overall evaluation of the pain-free bias phenomenon [2].

Observations of pain-related behaviours allow the understanding of painful manifestation regarding the interpretation and response to painful stimuli in which an individual can intentionally manipulate the results by claiming functional limitations to work as a function of pain as well as tolerance or stimulus of pain.

There is no single assessment of the painful phenomenon of a universal character that incorporates the three main categories: measurement of physiological pain responses, observations of pain-related behaviours, and verbal or written descriptions of pain and variables associated therewith [3].

Physiological responses to pain are usually performed in specialized laboratories with unacceptable margins of error and poor geographical distribution, making it difficult to perform a more complete and integrated assessment at the universal level. They are limited to measuring only the tolerance threshold and pain resistance, and do not provide the necessary anatomical and / or systemic visual attributes.

On the other hand, the procedures most used by health professionals are verbal or written descriptions of pain, which are limited to only access of the motivational-affective, sensory-

discriminative and cognitive-evaluative components. Such components reflect an opinion of the individual in question; an opinion subject to fraud and distortions to achieve the desired result [4].

Many people report pain in the absence of tissue injury or any other likely pathophysiological cause; usually this happens for psychological reasons. It is not yet possible to distinguish his experience that it is due to tissue injury if we accept the subjective report. If they regard their experience as pain and report it in the same way as pain caused by tissue damage, it can be mistakenly accepted as pain. This definition avoids linking the pain to the stimulus [5]. The activity triggered in the nociceptor and nociceptive pathways by a stimulus is not pain. This represents a psychological state, although it is known that, for the most part, pain presents an immediate physical cause, very important to discern pain, but is not used [6].

Currently, the theoretical approach to pain is that it is a biopsychosocial phenomenon that results from a combination of biological, psychological, behavioural, social and cultural factors and not a dichotomous entity [7].

In an attempt to assess pain and identify its truth, systems that are not appropriate to the basic characteristics of pain as a physiological expression caused by tissue injury are often used. Investigations such as: X-ray, CT, ultrasound, blood tests, electromyography, myelography and magnetic resonance imaging, are inadequate to provide an image or diagnosis relevant to the degree of pain presented. Even visually reported and diagnosed anatomical dysfunctions are not necessarily associated with pain experienced by the individual [8].

This article presents the proposal of a multidimensional measurement system of pain in the human body.

2. Materials and methods

The developed system is multidimensional and considers the location, intensity, and suffering occasioned by the painful experience.

The process of evaluation and quantification of pain is composed of the main steps as shown in Figure 1, which involve anatomical, physiological and environmental measurements, as well as the collection of subjective information of a psychological nature.

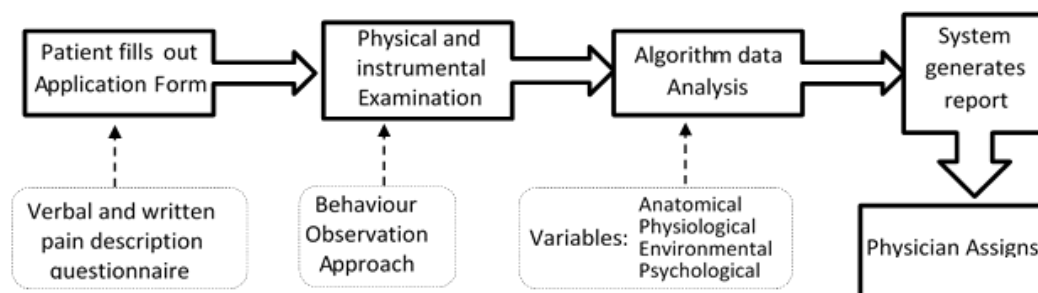


Figure 1. Stages of the pain measurement process

The system data collection begins with the patient providing information through the completion of a questionnaire, verbal descriptions and behaviour observations. In this step the patient assigns, based on their perception, a value of 0 to 10 for their pain.

Subsequently, the patient undergoes physical examination in a device for scanning measurements, integrated, which performs the anatomical measurements, such as body mass and height, physiological measurements such as absolute temperature and cutaneous temperature; and environmental measurements such as local temperature and humidity. It should be noted that the measurement sensors of the Scanning device are regulated and calibrated by a laboratory accredited by the Brazilian Institute of Metrology, Quality and Technology - Inmetro, which ensures adequate metrological reliability of the measurements.

In the next step, dozens of variables such as those measured by the Scanning device and those collected in the first step are introduced into the connected computer programming incorporated in the Scanning device, where algorithms perform the mathematical calculations and generate a wealth of information about the patient's assessment and level of pain.

It should be noted that the construction of algorithms that assign value to pain intensity considered the result of more than 600 scientific studies during years of bibliographic research that demonstrate the effect of variables that affect pain and its perception.

Some of the information generated by the algorithm is used in the next step for the composition of the Report, especially for the elaboration of the Pain Quantification Chart.

Figure 2 presents part of a Report with significant information and images to support the health professional's decision making in the final stage of the pain measurement process.

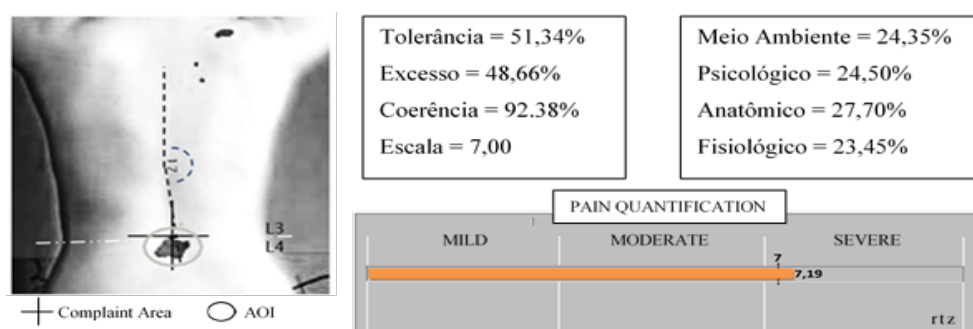


Figure 2. Stages of the pain measurement process

The Pain Quantification Chart uses a pain scale from 0 to 10 and introduces the "rtz" as the unit of measurement of pain on this scale.

The rtz scale is divided into three levels of intensity: mild, moderate, and severe. The "mild" level is attributed to individuals with little pain that does not prevent them from performing physical functions regarding the Area of Interest (ADI). At the moderate level, the individuals subject to further investigation are classified and, depending on their physical demand, the rtz value of the scale can be decisive in the decision of a more effective treatment. At the "severe" level are the individuals with pains that affect their physical activity related to the Area of Interest (ADI) and affect what is considered normal daily life activities.

In the case relating in Figure 2, the patient indicated the value 7 for his pain, while the system assigned gave the result 7.19rtz, indicating a consistency of 92.38% between the individual's perception and the calculated algorithm.

The image shows the location of the Patient's Pain Complaint Area and the Area of Interest (ADI). These two areas tend to overlap in cases of honest patient assessments in describing their pain.

The report shows that the group of variables that most affected the outcome of the evaluated patient was the anatomical group with 27.7% indicating the need for further investigation in this section.

In both preclinical evaluations in mice and in humans in a clinical setting, the information generated in the reports was of great value in the decision making of individual treatment. Taking into account a larger group of variables associated with pain with an observation of the individual's physiological response and their cognitive responses, the system becomes a unique universal assessment of the pain phenomenon. The acquired values of the metrological analysis are of great importance in biomedical studies increasing the accuracy in pain diagnoses and better treatment efficiency.

3. Conclusions

The presented system is an effective instrument for the measurement of pain, because it presents properties of a ratio scale; provide immediate information on the reliability of patient performance; be

relatively free of bias; be simple to use in individuals with pain and in individuals without pain; usable in both clinical and research contexts; be reliable and can generalize; being sensitive to changes in pain intensity; to be able to assess separately the different dimensions of pain; demonstrate utility for both experimental pain and clinical pain, allowing reliable comparisons between both types of pain.

This set of attributes collected in this system represent a technical advance for the measurement of pain level and the rtz scale creates reference parameters for its quantification, which portrays another contribution of metrology to health science.

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