

# THE MEASUREMENT OF PAIN - A BRIEF REVIEW

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## Summary

*Physiotherapists are now measuring pain when they assess their patients. Pain has been considered to be unmeasurable by some, but a number of subjective and objective methods have been devised. Subjective methods appear to be more satisfactory than objective methods. Several methods of subjective measurement are reviewed. Studies suggest that the Numerical Rating Scale (N.R.S.) may be an appropriate subjective scale for general use. Several methods of measuring pain relief are also reviewed. Patients tend to express themselves more in terms of pain relief than in terms of pain measurement. The principles of the Signal Detection Theory for quantification of pain are outlined.*

## Opsomming

*Fisioterapeute meet nou pyn wanneer hulle hul pasiënte evalueer. Pyn is deur sommige as onmeetbaar beskou, maar 'n aantal subjektiewe en objektiewe metodes is ontwerp. Subjektiewe metodes blyk meer bevredigend te wees as objektiewe metodes. Verskeie metodes van subjektiewe meting word hersien. Studies stel voor dat die Numeriese Waardebepalingskaal (Numerical Rating Scale, N.R.S.) 'n geskikte subjektiewe skaal vir algemene gebruik mag wees. Verskeie metodes om pynverligting te meet word ook hersien. Pasiënte is geneig om hulself eerder in terme van pynverligting as pynmaat uit te druk. Die beginsels van die Sein Vasstellingsteorie (Signal Detection Theory) van pyn kwantifisering word geskets.*

## INTRODUCTION

One of the most important developments in the physiotherapy profession during the last few years has been the increasing emphasis on good assessment prior to physiotherapeutic intervention.

Measurement is the essence of scientific method and during their assessment of patients, physiotherapists routinely measure such things as muscle strength and joint motion, but until recent times it has not been usual for them to measure the major accompaniment of so many of the conditions they treat, namely pain.

According to Huskisson (1974) "pain cannot be said to have been relieved unless pain or pain relief has been directly measured". Thus the question of the feasibility of pain measurement must be raised. Pain is an abstraction and therefore has been considered by many to be unmeasurable.

However, psychologists have been confronted by similar problems relating to the measurement of personality, depression and sleep, and they have coped with this since the early part of the century.

When measurement of pain is being considered, a distinction must be made between experimental and clinical pain. Measurement of pain in the laboratory is relatively easy. Specific and graded stimuli can be used and the responses analysed. It is thus possible to obtain a large degree of sameness in experiments and relatively reproducible results can be obtained (Rosen, 1977). However, with clinical pain the nature of the stimulus may not be obvious and in some cases pain levels give no indication of the severity of the disease. In addition pain may be modified by many behavioural factors (Huskisson, 1974).

The problem of pain measurement has been approached basically in two ways. The most used is the "subjective" method in which the patient is asked to report his pain experience directly. Alternatively an "objective" or indirect measure (visible or non-verbal) can be used if there is a relationship between the measure and relief of pain (Rosen, 1977).

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There are several ways by which subjective measurements of pain can be obtained. The simplest form is a qualitative scale by which the patient reports the presence or absence of pain. Alternatively, the patient can be asked to express his pain in ordered categories, that is, using words to explain various levels of pain. Numerical rating scales can also be used in which a number is allocated to a given pain level.

**SIMPLE DESCRIPTIVE SCALE (S.D.S.)**

This method consists of four or five points based on a simple verbal description of pain, for example, NIL, MILD, MODERATE, SEVERE and VERY SEVERE (figure 1). This method has the advantage that it is relatively easy for the patient to understand and use. However, it has the distinct disadvantage that it lacks the required sensitivity for detecting small changes. For example a patient may have pain which he considers to be more than moderate but not sufficient to be reported as severe, so in practice he tends to group his responses to one or the other. Another disadvantage of this scale is that it may give rise to the assumption that the intensity of pain increases or decreases in a linear manner between the various grades.



Fig. 1 Simple Descriptive Scale (S.D.S.)

**NUMERICAL RATING SCALE (N.R.S.)**

This method consists of an 11 point (0-10) or a 21 point (0-20) scale, numbers being allocated in ascending order according to reported pain intensity (figure 2).

The N.R.S. is more sensitive than the S.D.S. but this type of scale has disadvantages similar to those of the S.D.S.

**VISUAL ANALOGUE SCALE (V.A.S.)**

This method uses a straight line, conventionally 10 centimetres long, the extreme limits of which are marked by perpendicular lines. The ends of the main line, which may be vertical or horizontal, carry a verbal description which denote the extremes of the pain to be evaluated, that is "no pain" and "pain as severe as could be" (figure 3). The patient is asked to mark the line at the position between the two extremes, which represents the level of pain. This scale is the most sensitive of those available, as the number of possibilities is infinite. It has a disadvantage in that it may present some patients with a concept of pain measurement which they find difficult to understand.

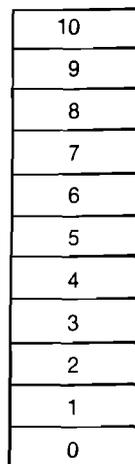


Fig. 2 Numerical Rating Scale (N.R.S.)

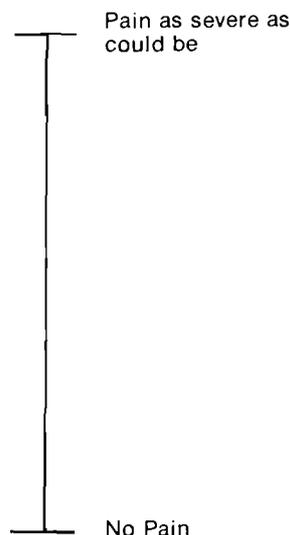


Fig. 3 Vertical Visual Analogue Scale (V.A.S.)

**RELIABILITY AND VALIDITY OF SUBJECTIVE PAIN SCALES**

The usefulness of subjective pain scales depends on the two important factors of reliability and validity (Macrae, 1977). Reliability depends on absence of random or systematic error. This is often difficult to achieve in any measurement process, particularly if it is a psychological measurement. However, the important requirement is that the error be as small as possible in relation to the use made of the measurements.

Validity of subjective pain scales is very difficult to establish as the very nature and meaning of the measurement is always in question. When a physical measurement is being made there is usually no problem regarding validity as there is little doubt about what is being measured. However, with a personal, individual experience like pain, there is always some doubt about whether what is supposed to be measured, is, in fact, being measured (Macrae, 1977).

## VALUE OF SUBJECTIVE PAIN SCALES

Downie *et al* (1978) studied subjective pain rating scales using patients with a variety of rheumatic diseases. Their main finding was that there was good correlation between the pain scores obtained from the S.D.S., N.R.S. and V.A.S. Their evidence indicated that the scales were measuring the same underlying pain as there was good calibration. Their evidence also indicated that the 11 point (0-10) N.R.S. performs better than either the S.D.S. or V.A.S. They also prefer the N.R.S. on the grounds of measurement error and suggest that it provides a good compromise between the S.D.S., which offers only a few choices and the V.A.S., which some patients find difficult to use, mainly due to the confusion caused by the great freedom of choice it offers.

In a study conducted by the author, an evaluation of the use of three subjective pain rating scales (N.R.S., S.D.S. and V.A.S.) was made, using 50 African patients who had been referred to the physiotherapy department for treatment. Analysis of data showed that the N.R.S. correlated well with the V.A.S., but neither the N.R.S. nor the V.A.S. correlated well with the S.D.S. Of the 31 patients who were asked to give their preference of scales, 14 preferred the N.R.S., 6 the S.D.S. and 4 the V.A.S. Seven had no preference. The findings suggest that the N.R.S. is probably the most appropriate subjective method of rating pain in the above patients, followed closely by the V.A.S. The S.D.S. appears to be a relatively poor scale.

Although several methods of objective pain measurement have been described, a reliable and valid method remains elusive. Huskisson (1974) describes several objective methods including measurements of respiratory function, hormone levels and grip strength as they relate to appropriate painful conditions.

Major deleterious changes occur in respiratory function after upper abdominal and thoracic surgery. For example, the average fall in arterial oxygen tension and functional residual capacity after upper abdominal operations is 25 per cent. Changes in vital capacity are even greater. It is possible for these changes to be improved by providing adequate pain relief. However, even the most perfect pain relief does not return respiratory function to pre-operative levels; therefore the use of lung function measurements as an objective assessment of pain level is limited.

Excretion of catecholamines in urine has been measured in patients with rheumatoid arthritis treated with simple analgesics. These measurements are regarded as being of only limited sensitivity. Also, in patients with rheumatoid arthritis, grip strength may be used as an objective measure of pain. Usually, as pain subsides, either after intervention or during a natural remission, the grip strength increases.

Fairbank, O'Brien and Davis (1979) report an objective method for measuring back pain. This relates to the rise in intra-abdominal pressure during lifting; pressure being directly proportional to the theoretical loading of the lumbar spine. Intra-abdominal pressure was measured with an intragastric pressure transducer. Rises in pressure were plotted against a pain rating and some correlation was demonstrated between pressure rise and perceived pain. The evidence indicated that pressure rises may be related to low back pain and, therefore, may be used as a method of objectively measuring such pain.

Although it is highly desirable that good objective methods of pain measurement be sought, most of those evaluated so far have been found to be unreliable.

## MEASUREMENT OF PAIN RELIEF

In assessing the effects of treatment, pain relief can be measured instead of pain severity. According to Huskisson (1974) this has three advantages:

- the magnitude of the response does not depend on the initial pain severity, all patients starting from the same baseline;
- it is not necessary to assume that differences in various parts of the scale are equal;
- it is more usual for a patient to express himself in terms of pain relief by saying "my pain is a little better" rather than "my pain is now moderate".

Pain relief can be measured by calculating the difference between the pain score after treatment and the initial score. Huskisson gives the following account of the methods which can be used for measuring pain relief:

- a simple descriptive pain-relief scale, in which the patient scores pain relief as EXCELLENT, GOOD, MODERATE, POOR, DOUBTFUL or ABSENT; alternatively NONE, SLIGHT, MODERATE or COMPLETE.
- numerical pain relief scales; patients can be asked to assess their present pain as a percentage of the initial level.

Another method is to express pain relief in fractions, for example, pain is more than half relieved or less than half relieved; such a scale has ample scope to improve its sensitivity.

## SIGNAL DETECTION THEORY FOR QUANTIFICATION OF PAIN

The methods already described for measuring pain are rather incomplete indicators; at best they can provide guides to patient's pain levels. There is a tendency for them to reinforce the idea that pain can be measured in a series of steps starting with an initial threshold and continuing through a rising scale from nil to the worst possible pains.

A concept of pain assessment has been introduced with its origins in communications engineering. This is called the "signal detection theory", or more descriptively the "sensory decision theory." The idea was developed, in relation to pain by Clark (1969). The principle of the theory is that pain threshold has two components:

- a measure of sensory discriminability which remains unaltered whatever the changes in the patient's expectation, mood and motivation;
- an assessment of the subject's response bias or attitude.

In short the theory can be applied to distinguish between the pain experience itself and the patient's criteria for reporting pain. Application of the theory requires repeated tests of pain thresholds and responses, the results are then analysed by mathematical processes usually applied in communications engineering to separate meaningful signals, relating to pain, from so-called background "noise." In reality the theory is an elaborate statistical process which has been mainly applied in a laboratory situation. However, there is now increasing use of the Signal Detection Theory in the clinical situation (Lancet, 1980).

## CONCLUSION

This brief review has presented some of the methods which may be used for measuring pain. It is inevitable that there are many differing opinions on the subject. The following

statement by Houde (1977) probably puts the whole subject into perspective: "at present we have no better measure of pain than the patient's own report of its presence and severity in his own words."

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