

## Pressure Threshold Meter: Its Use for Quantification of Tender Spots

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**ABSTRACT.** Fischer AA: Pressure threshold meter: its use for quantification of tender spots. *Arch Phys Med Rehabil* 67:836-838, 1986.

• The pressure threshold meter (PTM) and its use for evaluation of tender spots and trigger points are described. Pressure threshold is the minimum pressure inducing pain or discomfort. The PTM consists of a force gauge (11kg range) to which a rubber disc with 1cm<sup>2</sup> surface is attached. This surface has been proven adequate for quantification of deep tenderness in soft tissues. Normal threshold values were established in 50 volunteers, 24 men and 26 women, at nine different sites frequently affected by trigger points, including the trapezius, supraspinatus, infraspinatus, teres major, lumbar paraspinals (2 sites), gluteus and pectoralis muscles. The deltoid, where muscle sensitivity is usually normal, was used as a reference. PTM is used clinically for quantification of tenderness for medicolegal purposes, but primarily to prove the presence of trigger points to patients and health professionals. Reaction to various forms of treatment such as physiotherapy and drugs can be assessed quantitatively. When trigger point injections are properly administered to affected areas, pressure threshold measurements usually increase by 4kg/cm<sup>2</sup>. Failure to increase the reading indicates that the injection was incomplete and the procedure should be repeated. The PTM can be used for monitoring tenderness, inflammation, arthritis activity, and fibrositis.

**KEY WORDS:** Pressure; Threshold; Trigger points

Several authors have described the use of a pressure (force) gauge attached to a rubber disc, for measurement of pain sensitivity. Head (cited by Keele)<sup>6</sup> called the device an "algometer," and used it to study thalamic syndrome. Keele,<sup>6</sup> referring to a similar device as a "pressure algometer," established normal values over the forehead. The device featured flat 0.5cm circular end and calibration to 7.7kg.

The author of this article found the 0.5cm diameter surface suitable for measurement of pain sensitivity in skin, but not sufficient to transmit pressure to deeper tissues such as muscles and ligaments. A disc-plunger with a larger surface was necessary to cause pressure to these tissues. Clinical experience with patients suffering from trigger points has shown the suitability of a disc with a 1cm<sup>2</sup> surface for measurement of deep tissue tenderness in muscles, ligaments, joint capsules and tendons.

Pressure algometers have been successfully employed for the assessment of general sensitivity to pain in normal tissues.<sup>3,6</sup> This report describes the use of a device for quantifying tenderness in hypersensitive spots.

Steinbroker<sup>16</sup> used a pressure gauge to quantify palpation. Pressure threshold has been used to evaluate arthritis<sup>5,8,9,12</sup> and has proved useful in evaluating pain sensitivity,<sup>3,6</sup> fibrositis,<sup>1,12,13</sup> and abdominal pain,<sup>18</sup> as well as in psychological research.<sup>10</sup>

The reliability of pressure threshold between different investigators, occasions, and sites has been established.<sup>10,11,14</sup> The PTM described in this article has been proven to be reliable for measurement of myofascial trigger point sensitivity.<sup>14</sup>

Localized tenderness, as measured by pressure threshold, is the diagnostic hallmark of tender spots<sup>1</sup> and trigger points<sup>7,15,17</sup>. The usefulness of the pressure threshold meter (PTM) in doc-

umenting the response of trigger points to treatment such as injections and physiotherapy has been described.<sup>2,7</sup>

### Description of the PTM

The PTM<sup>a</sup> (fig) is a force gauge fitted with a rubber disc having a surface of 1cm<sup>2</sup>. Pressure can be applied to a defined surface on the body through the rubber disc. The gauge is calibrated in kg/cm<sup>2</sup>. A gauge with an 11kg range is used to determine pressure threshold, ie, minimum pressure inducing pain. A higher-range 17kg gauge is available for measuring pressure tolerance, ie, the maximum pressure tolerated, which expresses sensitivity to pain.<sup>3</sup> The device consists of a body attached to a metal rod with a male thread on the end. The rubber disc screws onto the rod. Pressure exerted on the rod moves the indicator in a clockwise direction. Pressing the zeroing knob returns the indicator to zero after each measurement. The achieved force value is held until the zeroing knob is pressed (maximum hold function), allowing a reading even after the meter is removed from the body.

### Pressure Threshold Measurement in Clinical Practice

The procedure consists of three steps:

**1. Preparation and positioning of the patient.** Explain to patient, "I am going to measure pressure threshold, that is, how much pressure will induce discomfort. This will also allow us to assess your progress." Show the PTM to patients and explain, "I am going to increase pressure slowly with this device. Please say Yes when you feel any discomfort. I will stop the pressure as soon as you say Yes so it won't hurt you."

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Pressure threshold meter.

The patient lies supine or prone depending on the site to be measured, supported by pillows to allow complete relaxation. Relaxation of muscles covering tender spots is essential for accurate measurement. Careful palpation is used in order to detect spasm in areas to be measured. Ask the patient to relax and reassure him that the procedure will not hurt. The patient may be seated on an examination table for measurement in the extremities.

**2. Identification of maximum tender spot.** Have patient pinpoint maximum pain area with one finger. Palpate painful area with fingertip to identify point of maximum sensitivity.

The pain area indicated by patient may be referred from a trigger point. Therefore it is important to know the referred pain patterns<sup>7,15,17</sup> of each trigger point in order to identify the source of pain and induce its proper treatment.

**3. Measurement of pressure threshold.** Apply the pressure gauge to the point of maximum sensitivity by placing the gauge at a 90° angle vertical to the skin. Tell the patient, "Say Yes when you feel discomfort."

Increase the pressure continuously at an even rate, about 1kg/sec. This is achieved by counting one and thousand, two and thousand, three and thousand and so on while increasing the pressure evenly so that the dial corresponds to your count. Stop the pressure and remove the pressure gauge immediately for reading when patient says Yes, indicating his pressure threshold.

Some patients demonstrate pain by pulling away or grimacing. In such cases, request again that the patient indicate the starting point of pain verbally. Pulling away and grimacing is considered a later sign of pain than the verbal response.

The most frequent cause of error is failure to find the exact

#### Normal Values Obtained in Pain-free Control Subjects

|                    | Women  |         | Men    |         |
|--------------------|--------|---------|--------|---------|
|                    | Lowest | Average | Lowest | Average |
| Upper trapezius    | 2.0    | 4.0     | 2.9    | 4.7     |
| Pectoralis         |        |         | 3.0    | 5.1     |
| Levator scapula    | 2.7    | 4.2     | 3.6    | 5.2     |
| Supraspinatus      | 2.8    | 4.2     | 3.8    | 6.0     |
| Teres major        | 2.7    | 4.0     | 4.1    | 6.0     |
| Infraspinatus      | 3.0    | 4.8     | 4.6    | 6.9     |
| Deltoid            | 3.1    | 4.8     | 5.1    | 7.3     |
| Lumbar paraspinals | 3.8    | 5.7     | 5.6    | 8.0     |
| Gluteus medius     | 3.7    | 6.0     | 4.3    | 6.4     |

point of maximum tenderness at step two. Missing the maximum tender spot by a few millimeters often results in a reading false by several kg/cm<sup>2</sup>.

Similarly, it is important to localize exactly the corresponding spot and structure on the other side of the body for comparison of pressure threshold.

#### Evaluation of Results

The following three conditions are considered abnormal:

1. Difference in pressure threshold between two symmetric points in the same person exceeding 2kg/cm<sup>2</sup>.

2. Pressure threshold lower than 3kg all over the body. These criteria evolved from the author's clinical experience and judgment. The clinical value of the criteria has been confirmed by many clinicians who have used the PTM.

3. Low pressure threshold values as compared to normal values obtained in pain-free control subjects.

The table shows normal values (84% security) obtained in 50 control subjects, 24 men and 26 women. Muscles which are frequently afflicted by trigger points were measured. The reproducibility and validity of pressure threshold measurements were excellent. There were no significant differences in corresponding muscles on opposite sides of the body.

#### DISCUSSION

Experience with PTM over ten years in patients with varying myofascial pain conditions, particularly back, neck, and extremity pain, tension headaches, and temporomandibular joint dysfunction, has proved the clinical value of the method.

The higher the reading, the less tenderness is present. A lower reading indicates greater tenderness. Improvement is shown by a higher threshold.

Pressure threshold measurement findings can be confirmed by objective methods such as thermography<sup>4</sup> and tissue compliance measurement.<sup>2</sup> The latter can also determine objectively and quantitatively changes in muscle tone or consistency diagnosed by palpation.<sup>2</sup> Increased resistance (decreased softness or compliance) in the form of taut band is recognized as diagnostic of myofascial trigger points.<sup>15,17</sup>

#### Clinical Use of PTM

PTM has been used successfully in clinical practice for the following purposes: Diagnostic application of PTM includes measurement of pressure sensitivity and identification of abnormal tenderness.<sup>1,2,4,7,14,18</sup> The gauge assists in locating tender spots and trigger points. Follow up of change in pain

and tenderness is also possible. One of the most important uses of PTM is the demonstration to patients and to health practitioners the presence of abnormal tenderness as well as improvement by treatment. Activity of arthritis can be quantified by pressure threshold measurement.<sup>5,9</sup>

Effects of treatment can be quantified, including injections, physical therapy modalities, or manipulation. Effect of painkillers and antiinflammatory medication can be quantified.

Documentation of pain and soft tissue pathology by presence of abnormal tenderness as well as quantification of its intensity (sensitivity) is of great value in medicolegal practice. Reproducibility of pressure threshold measurement indicates that the records of pain intensity are reliable.

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