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# Ocena wrażliwości uciskowej przy użyciu algometru

*Evaluation of the pressure pain threshold using an algometer*

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## **Streszczenie:**

**Wstęp.** W diagnostyce dla potrzeb fizjoterapii bardzo istotnym elementem są metody pomiarowe, które zapewnią precyzję pomiaru, powtarzalność, dostępność, łatwość w wykonaniu. Prawidłowo wykonana diagnostyka umożliwia właściwy dobór terapii, zapewnia większą skuteczność podjętych działań i pozwala na uzyskanie zamierzonych efektów. Jedną z metod coraz częściej wykorzystywanych przez terapeutów jest pomiar wrażliwości uciskowej tkanek za pomocą algometru. Metoda ta zapewnia ocenę obiektywną, dokładną i powtarzalną.

**Materiał i metody.** W badaniach brało udział 20 zdrowych, młodych osób, w przedziale wiekowym od 20 do 30 r.ż. Wykonano u nich zabieg masażu klasycznego grzbietu, który obejmował opracowanie wybranych mięśni powierzchniowych i głębokich. Zabieg trwał 20 minut. Przed masażem i bezpośrednio po zabiegu dokonano pomiaru wrażliwości uciskowej wybranych mięśni grzbietu, w miejscu przyczepów kostnych, przy użyciu algometru.

**Wyniki.** Po zastosowaniu masażu klasycznego odnotowano zwiększenie wartości wrażliwości uciskowej przyczepu kostnego wybranych mięśni grzbietu. Różnice istotne statystycznie odnotowano w przypadku mięśni czworobocznych.

**Wnioski.** Pomiar wrażliwości uciskowej tkanek przy użyciu algometru stanowi obiektywną metodę umożliwiającą obrazowanie efektów zastosowanych terapii, w tym przypadku wpływu masażu na wrażliwość uciskową tkanek.

## **Słowa kluczowe:**

wrażliwość uciskowa, masaż klasyczny, algometr

## **Abstract**

**Introduction.** Measurement methods are a very important element in physiotherapy diagnostics to ensure measurement accuracy, repeatability, availability and they should be relatively easy. Properly performed diagnostics allows proper selection of therapy, ensures higher efficacy of the undertaken activities and allows to obtain the desired effects. The measurement of the pressure pain threshold with the use of an algometer is one of the methods applied more and more frequently by therapists. The method provides an objective, accurate and reproducible assessment.

**Material and methods.** The study included 20 healthy, young subjects, aged 20 to 30 years. They were subjected to classical massage of the back, which involved selected superficial and deep muscles. The procedure took 20 minutes. Before the massage and immediately afterwards, with the use of an algometer there was measured the pressure pain threshold of the selected back muscles at the site of bone attachments.

**Results.** After classical massage application, there were noted increased values of pressure pain threshold of selected back muscles attachments. Statistically significant differences were obtained in the case of the trapezius muscles - descending and transverse part.

**Conclusions.** The measurement of pressure pain threshold with the use of an algometer is an objective method which allows imaging of the effects of the applied therapy, in this case the effect of massage on the pressure pain threshold.

## **Key words:**

pressure pain threshold, classical massage, algometer

Badania zostały wykonane w ramach Uczniowskiego Mini Projektu Badawczego w zakresie innowacyjnego zastosowania w praktyce wiedzy z obszaru danego zawodu, realizowanego w ramach projektu „Modernizacja kształcenia zawodowego na Dolnym Śląsku II”.  
Priorytet IX- Rozwój wykształcenia i kompetencji w regionach  
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## Introduction

Pressure pain threshold (PPT) is determined as minimum pressure inducing pain [1].

The PPT values may vary depending on gender. The studies conducted to date have demonstrated higher pain threshold in men compared to women [2, 3, 4, 5, 6]. There have been also observed different pressure pain threshold values for individual muscles [7]. The area of the body where the measurement is performed is a factor affecting pressure threshold. The tissues of the cervical spine are more sensitive than tissues located in the lower spine [2, 4]. Vanderween et al.(1996) noted that the PPT values of the shoulder girdle and the upper limb tissues were lower than those of distally located tissues of the forearm and hand [2].

In the case of healthy muscles, PPT exhibits different values, it can be as high as 10 kg/cm<sup>2</sup>, but this amount of pressure may, according to many authors, cause micro-injuries and bruises [8]. Fischer in his research pointed to the difference occurring on both sides of the body during the measurement of pressure threshold. The difference in PPT value greater than 2 kg/cm<sup>2</sup> is an important result, as it can be the evidence of progressing pathological problem within them [1, 7]. Algometer is a device for measuring the sensitivity to pressure [1]. With its help pressure pain threshold is determined, i.e. the value of the applied force which induces pain. The pressure is measured in kilogram-force per cm<sup>2</sup> [7]. The measurement of the pressure pain threshold is an element showing the obtained effects of the applied therapeutic procedures [2, 9]. During the examination, the therapist locates the point of the maximum sensitivity and applies the algometer head vertically to the spot and increasing the force presses it into the painful spot [9]. The measurement is registered when the examined subject presses the button at the onset of pain [9]. Measurements using algometer should be performed before the treatment in order to determine the tissue dysfunction [7]. Such measurements should be also performed after the application of i.e. classical massage (CM), therapeutic massage (TM) or connective tissue massage (CTM) [10, 11, 12]. Examination of the pain threshold using an algometer can be performed in case of exercise-induced delayed onset muscle soreness (DOMS), muscle pain, inflammation of muscle fibers, arthritis, when examining soft tissue trigger points, myofascial pain syndrome [7, 9, 11].

Evaluation of pressure pain threshold using an algometer is a simple method and an objective form of an examination. In the opinion of many authors it is a reliable method of measurement, characterized by high repeatability, accuracy and precision [1, 2, 7, 13, 14, 15, 16].

## Material and Methods

### Recipients

The study group included 20 healthy students of the University of Physical Education and Post-Secondary School in Wrocław, aged from 20 to 30 years (mean age 25 years). They did not report any pain, declared no use of analgesics in the last 3 months, no physiotherapy provided.

### Methods

The study consisted of evaluating the pressure pain threshold using a device called algometer (Figure 1). The device was designed by the Massage Unit, the Chair of Physiotherapy, University of Physical Education in Wrocław and made at the Technical University in Wrocław within the framework of scientific cooperation.



**Fig.1. Algometer**

The tested individual was informed about the course of the study, the principles of cooperation during the measurement and possibility of withdrawal from the measurement. Before the actual measurement, the researcher demonstrated the assessment of selected muscle attachments so that the tested individual could distinguish between pressure and pain and could, at the right moment, stop the pressure measurement. Then the researcher performed the measurement on bone attachments of individual muscles of the back (Table 1) [17, 18]. The next stage of the research was to perform classical massage of the back. After the procedure the pressure pain threshold of the same muscle attachments was measured again. Measurements were performed on the right and left side, in prone position. The obtained results were recorded on a card specially prepared for tests (table 2).

**Table 1. Pressure pain threshold measurement site on selected muscles**

No.	Muscle	Attachment location
1	Latissimus dorsi	External lip of the iliac crest
2	Trapezius transverse part	Acromion of the scapula
3	Trapezius descending part	Acromial end of clavicle
4	Extensor spinae	Posterior superior iliac spine

**Table 2. Pressure pain threshold examination card**

Muscle	Before massage		After massage	
	right	left	right	left
Latissimus dorsi				
Trapezius transverse part				
Trapezius descending part				
Extensor spinae				

#### Massage methodology

The classical massage method included the proper positioning of the massaged person. For this purpose wedge cushions were used to ensure normal venous blood and lymph flow and relaxation of the maximum number of muscles. This position complied with the requirements of safety and comfort for both, the massaged and the masseur, which enabled the proper performance of the procedure. The methodology of classical massage of the back consisted of

the initial part in which skin and dorsal fascia were worked using appropriate techniques. In the main part muscles were worked starting from those lying superficially, heading for deeper ones. The end part comprised deep stroking of the back and supraspinous ligament rubbing. The massage lasted 20 minutes.

### Statistical analysis

The results of the pressure pain threshold performed at each measurement point for each side of the body were summed and the mean population value of the pressure force was calculated for each muscle. In order to determine the distribution of the obtained results the Shapiro-Wilk test was used at the level of significance  $p=0.05$ . As the distributions of the variables did not differ significantly from normal distribution, the hypotheses of lack of differences were tested using parametric Student's paired t-test.

### Results

The results of the study are presented in tables 3 and 4. The first table includes the mean values of the pressure pain threshold obtained on muscle attachments on the right side of the body before and after the massage procedure. The second table demonstrates the mean values of the pressure pain threshold on the same muscle attachments on the left side.

**Table 3. Mean values of the pressure pain threshold obtained on tissue attachments located on the right side before and after the massage**

Muscle	Before massage Right side	After massage Right side
Latissimus dorsi	5.29	5.36
Trapezius transverse part	4.20	4.99
Trapezius descending part	3.95	4.84
Extensor spinae	5.82	5.84

**Table 4. Mean values of the pressure pain threshold obtained on tissue attachments located on the left side before and after the massage**

Muscle	Before massage Left side	After massage Left side
Latissimus dorsi	5.36	5.79
Trapezius transverse part	4.07	4.98
Trapezius descending part	3.61	4.45
Extensor spinae	5.98	6.64

Table 5 presents the results of the comparison of mean values of the pressure pain threshold of the investigated tissues located on the right and left side of the body before and after the massage.

**Tab. 5. Comparison of the mean values of pressure pain threshold of the investigated tissues located on the left and right side of the body before and after massage**

Muscle	Before massage (M ±SD)	After massage (M ±SD)	before vs. after
Latissimus dorsi - left side (L)	5.68 ±1.40	5.92 ±1.27	p = 0.315
Latissimus dorsi - right side (R)	5.25 ±1.61	5.76 ±1.82	p = 0.112
L vs. R	p = 0.424	p = 0.783	x
Trapezius transverse part - left side (L)	5.89 ±1.34	6.57 ±1.23	p = 0.103
Trapezius transverse part - right side (R)	5.75 ±1.47	6.35 ±1.75	p = 0.106
L vs. R	p = 0.708	p = 0.614	x
Trapezius descending part - left side (L)	4.14 ±1.16	4.78 ±1.07	<b>p = 0.004</b>
Trapezius descending part - right side (R)	4.16 ±1.12	4.91 ±1.09	<b>p = 0.005</b>
L vs. R	p = 0.947	p = 0.698	x
Extensor spinae - left side (L)	3.57 ±0.97	4.18 ±1.21	<b>p = 0.014</b>
Extensor spinae - right side (R)	3.84 ±0.86	4.82 ±1.29	<b>p = 0.004</b>
L vs. R	p = 0.304	p = 0.203	x

M – mean, SD – standard deviation, p – Student's paired t-test level of significance

The mean values of the pressure pain threshold of bone attachment of all tested muscles increased after the massage. A statistically significant effect of massage on the pressure sensitivity of the tested muscles was recorded for trapezius muscle ( $p < 0.01$ ) in both examined parts, on both sides of the body. There was no statistically significant asymmetry (L vs. R) of any muscle ( $p > 0.05$ ), both before and after the massage.

### Discussion

In many studies, there are used different types of pain scales: visual-analogue (VAS), numerical (NRS) and verbal (VRS) as well as questionnaires concerning perceived pain or quality of life (McGill Questionnaire, GHQ-28 Questionnaire) to determine the qualitative and quantitative aspects of pain. These diagnostic tools used for physiotherapy are available, easy and quick to perform methods but they provide subjective assessment.

In the diagnostics related to physiotherapy, a palpable evaluation of tissues is used to obtain information on the level of tension of tissues inducing pain [18]. It is an element of diagnostics for the needs of massage, allowing the selection of massage methodology which provides an individual approach to the patient and contributes to the monitoring of achieved therapeutic effects. This method requires a very good knowledge of the tissue anatomy and, most of all, the ability of precise repeatable application of pressure force.

The use of a measuring device the algometer is, enables the measurement of tissue pressure sensitivity, makes it easier to determine the amount of applied pressure inducing pain and allows to reproduce accurately the pressure force. Owing to these, the measurement made with the use of an algometer is a precise and objective measurement method [14]. It enables comparisons after the whole cycle of physiotherapeutic procedures or between individual procedures which facilitates the visualization of the therapy effectiveness [19].

The measurement of tissue pressure pain threshold can be performed in healthy young individuals, in athletes and in patients with chronic pain, most frequently after the application of specific therapy [9, 10, 11]. In one of the studies, after the applied classical massage due to delayed onset of gastrocnemius muscle soreness, higher values of pressure sensitivity were reported which confirmed pain relief [11].

In another study, in patients with chronic cervical spine pain, changes in the pain sensation after application of classical massage were presented by measurements performed with an algometer [10]. It was a clear way of monitoring the effect of the therapy and these measurements confirmed the positive effect of massage on pain reduction.

The carried out study demonstrated a tendency to higher value of pressure pain threshold in all the investigated back muscles, measured at the point of bone attachment after classical massage but of no statistical significance. Statistically significant changes were observed in the case of trapezius muscle. They may result from the fact that this muscle is very sensitive to stress and responds quickly in situations of psychological discomfort. The number of the investigated subjects and their health condition could have a significant influence on the result obtained for the other examined muscles. They were young, healthy individuals with no pain in the spine area.

### Conclusions

1. Algometer test demonstrated increased value of pressure pain threshold of selected back muscles attachments after application of classical massage.
2. The most changes were obtained in the case of the trapezius muscles - descending and transverse part.
3. There were no differences in the value of pressure pain threshold on the left and right side of the body in the investigated muscles before and after the massage.

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