ASSESSMENT OF THE IMPACT OF HOLD-RELAX AND CONTRACT-RELAX TECHNIQUES ON THE COMPRESSION PAIN THRESHOLD IN PATIENTS WITH LATERAL HUMERAL EPICONDYLITIS

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ABSTRACT

Background: The method of proprioceptive neuromuscular paving (PNF) is unique in that it has its own principles of working with the patient. The overriding therapeutic goal during PNF therapy is to work on a lost function that is important for the patient.

Aim of the study: The aim of the study was to assess the impact of Hold-Relax and Contract-Relax techniques on the compression pain threshold in patients with lateral humeral epicondylitis.

Material and methods: The study involved 60 patients aged 47.8 ± 4.3 with inflammation of the lateral humeral epicondyle. There were 35 women and 25 men in the study group. In each examined person it was the first incident of lateral humeral epicondylitis. In each of the probands, subjective and physical physiotherapeutic examination was carried out. 41 left and 19 right limbs were tested. Measurements were made under standard conditions. Among the physiotherapeutic tests performed were: examination of the range of motion, assessment of the compression pain threshold using an algometer, and pain assessment during extension and radial deviation of the wrist with a load. The study of the range of movement was carried out using an electronic goniometer. Then, the subjects were randomly divided into two groups: group “A” in which the Hold-Relax technique was performed on the muscle group that extends and radially deviates the wrist and group “B” in which Contract-Relax was applied to the same muscle group. The therapy lasted 30 minutes and was continued for the next 10 days. In each group, apart from the mentioned techniques, physiotherapy treatments were applied as indicated. After the therapy, the tests that preceded the therapies were repeated. The obtained results were placed in the database and subjected to statistical analysis using the Statistica program.

Results: The mean extent of the extension movement in the radiocarpal joint before the therapy in group “A” was 45.7 ± 4.7 while in group “B” it was 40.1 ± 3.79. After treatment, the mean range of motion increased in the “A” group to 67.46 ± 8.69 and in the “B” group to 71.6 ± 8.3. In both groups, changes were observed at the statistically significant level p = 0.

Conclusions: 1. The use of both the Hold-Relax and Contract-Relax techniques had an impact on the change of the compression pain threshold. 2. The use of Hold Relax and Contract Relax techniques has an impact on increasing the range of motion in patients with lateral epicondylitis.

KEYWORDS: PNF, pressure pain threshold, lateral epicondylitis inflammation

BACKGROUND

The method of proprioceptive neuromuscular paving (PNF) is unique in that it has its own principles of working with the patient. The overriding therapeutic goal during PNF therapy is to work on a lost function that is important for the patient. In contrast to traditional physiotherapy, muscle strength and range of motion are considered here only as a means to achieve the goal [1–3]. It is worth noting that this method has a group of techniques that are used to stretch and relax muscles. Among these techniques, the technique of Hold-Relax and Contract-Relax stands out [4,5]. It is
worth mentioning that there are no clear guidelines as to the number of repetitions or duration, or the application of a given technique to a given case in order to achieve optimal results.

Unfortunately, there are inaccuracies in the literature in the description of the techniques and methods used in PNF. Techniques which are described the same way do not necessarily correspond to the same method of implementation in different research protocols. PNF includes two main toning techniques: Hold-Relax and Contract-Relax. The first technique is used to work on muscles that have contracted. The therapist resists the isometric contraction of these muscles, then they are allowed to relax [3,6]. The "hold" command is used during this technique. The patient is instructed to maintain a certain position of the joint against the applied resistance. As mentioned before, the goal of this technique is to increase the passive range of motion and reduce pain. This technique is widely used, because the only contraindication to it is the inability of the patient to perform isometric contraction [7–9]. In the Contract-Relax technique, the therapist also puts resistance to the contorted muscle, but in this case, the command the physiotherapist says is, “Pull.” In contrast to the previous technique, this may lead to joint movement during its execution. Then, the relaxation phase and the range of motion increase. Additionally, in the case of work on muscle groups located in the torso, rhythmic breathing is indicated [10–12].

The International Association for the Study of Pain defines pain as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage.” Differences in the perception of pain stimuli come from the activation of various types of pain receptors. They also depend on individual psychological factors and the current mental state. Due to the subjectivity of pain sensation it is difficult to determine its intensity with a quantitative scale. In the performed tests, the algometer was used to measure the pain threshold. This method allowed precise determination of the place where the pain threshold was increased and enabled accurate assessment of the effects of the performed therapy. Considering the phenomenon of pain sensation, the differences between pain threshold and pain tolerance should be made clear. Pain tolerance is the maximum intensity of pain that a person can tolerate. It can be influenced by many factors, such as current physical condition, degree of concentration on pain or psychological well-being. The threshold of feeling pain is defined by the intensity of the sensory stimulus perceived by a person as pain. The smallest amount of pressure on tissue which causes pain, is referred to as tissue compression sensitivity. It is influenced by, among other things, musculoskeletal diseases, sex, and mental disorders [13–15].

“Tennis elbow” is a common name for inflammation of the lateral epicondyle of the humerus, or “lateral epicondylitis.” There are muscles attached to the lateral epicondyle that perform movements of the wrist. Ailments usually appear in conditions of chronic wrist overload. This situation occurs, for example, in tennis players, when the wrist is hard at work (hence the name of the disease). When lateral epicondylitis occurs, exercises to restore the flexibility and strength of the muscles are indicated; these exercises include, above all, stretching the finger extensors and flexors [16].

**AIM OF THE STUDY**

The aim of the study was to evaluate the effect of Hold-Relax and Contract-Relax techniques on the level of compression pain threshold in patients with lateral epicondylitis. The following research questions were asked:

1. Does the use of the Hold-Relax technique and Contract-Relax technique have an impact on changing the pressure pain threshold?
2. Does the use of the Hold-Relax technique and the Contract-Relax technique influence the range of motion in patients with lateral humeral epicondylitis?

**MATERIAL AND METHODS**

The study involved 60 patients at the age of $x = 47.8 \pm 4.3$ with inflammation of the lateral humeral epicondyle. There were 35 women and 25 men in the study group. In each examined person it was the first episode of lateral epicondylitis. In each of the probands, subjective and physical physiotherapeutic examination was carried out. 41 left and 19 right limbs were tested. Measurements were made under standard conditions. Among the physiotherapeutic tests performed were: examination of the range of motion, assessment of the compression pain threshold using an algometer, and pain assessment during extension and radial deviation of the wrist with a load. The study of the range of movement was carried out using an electronic goniometer. Then, the subjects were randomly divided into two groups: group “A” in which the Hold-Relax technique was performed on the muscle group that extends and radially deviates the wrist and group “B” in which Contract-Relax was applied to the same muscle group. The therapy lasted 30 minutes and was continued for the next 10 days. In each group, apart from the mentioned techniques, physiotherapy treatments were applied as indicated. After the therapy, the tests that preceded the therapies were repeated. The obtained results were entered in a database and subjected to statistical analysis using the Statistica program. The Shapiro-Wilk test was used to assess the normality of the distribution. Statistical analysis was performed using the Student’s T test for dependent tests, since at least one variable in each group had a normal distribution in each measurement. The level of statistical significance was $p \leq 0.05$. 

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The mean extent of extension in the wrist joint before the therapy in group “A” was 45.7±4.7, while in group “B” it was 40.1±3.79. After treatment, the mean range of motion increased in group “A” to 67.46±8.69 and in group “B” to 71.6±8.3. In both groups, changes were observed at the statistically significant level p = 0 (fig. 2).

The mean extent of flexion in the wrist joint before the therapy in group “A” was 42.53±3.52 while in group “B” it was 47.26±4.12. After treatment, the mean range of motion increased in group “A” to 59.23±9.65 and in group “B” to 67.53±7.5. In both groups, changes were observed at the statistically significant level p = 0 (fig. 3).

Pain was felt at point 1 in the “A” group before therapy at a mean of 41.8 N±6.27 N, while in group “B” it was
was 39.1 N±6.6 N. After therapy, more pressure could be applied before pain was felt, so that the mean pressure increased in the “A” group to 64.2 N±10.20 N and in the “B” group to 59.86 N±5.51 N. Both groups showed changes at the statistically significant level p = 0 (fig. 4).

Pain was felt at point 2 in the “A” group before therapy at a mean of 45.13 N±6.28 N, while in group “B” it was 41.1 N±5.44 N. After therapy, more pressure could be applied before pain was felt, so that the mean pressure increased in the “A” group to 59.77 N±6.28 N and in the “B” group to 54.13 N±4.8 N. Both groups showed changes at the statistically significant level p = 0 (fig. 5).

Pain was felt at point 3 in the “A” group before therapy at a mean of 42.27 N±3.32 N, while in group “B” it was 36.9 N±5.03 N. After therapy, more pressure could be applied before pain was felt, so that the mean pressure increased in the “A” group to 55.07 N±10.02 N and in the “B” group to 48.26 N±4.81 N. In the “A” group, changes at the statistically significant level p = 0 were observed. In the “B” group there were also changes at the statistically significant level p = 0.000027 (fig. 6).

Pain was felt at point 4 in the “A” group before therapy at a mean of 36.8 N±3.57 N, while in group “B” it was 32.23 N±6.07 N. After therapy, more pressure could be applied before pain was felt, so that the mean pressure increased in the “A” group to 62.13 N±2.61 N and in the “B” group to 60.67 N±8.31 N. Both groups showed changes at the statistically significant level p = 0 (fig. 7).

Figure 4. The average pain threshold expressed in newtons at point 1 before and after treatment in both groups.

Figure 5. The average pain threshold expressed in Newton in point 2 before and after therapy in both groups.

Figure 6. The average pain threshold expressed in Newtons in point 3 before and after therapy in both groups.
Pain was felt at point 5 in the “A” group before therapy at a mean of 31.23 N±3.67 N, while in group “B” it was 44.8 N±6.51 N. After therapy, more pressure could be applied before pain was felt, so that the mean pressure increased in the “A” group to 53.6 N±8.93 N and in the “B” group to 57.67 N±5.7 N. Both groups showed changes at the statistically significant level p = 0 (fig. 8).

The average weight value that patients were able to lift during the extension movement in the wrist joint without pain in the “A” group before therapy was 1.1 kg±0.56 kg and in the “B” group 0.95 kg±0.4 kg. After therapy, the mean amount of weight that could be lifted increased in group “A” to 1.78 kg±0.47 kg and in group “B” to 1.72 kg±0.54 kg. In the “A” group, the changes were statistically significant with a p value of 0.000004. In the “B” group the changes were also statistically significant (p = 0.001374) (fig. 9).

**Discussion**

In the conducted experiment it was observed that both the Hold-Relax technique and the Contract-Relax technique were beneficial for increasing the range of motion. In addition, after applying either technique there was an increase in the compression pain threshold at all examined points. The weight the proband could lift without pain also increased. The presented research results agree with other research regarding their impact of these techniques on increasing the range of motion [17–19]. However, the duration of contraction and relaxation in Hold-Relax and Contract-
Relax techniques remains unclear. The question of the number of repetitions also remains unclear. It is worth mentioning that the device for testing the pain threshold may be used in physiotherapeutic offices to assess the therapy. A quick and accurate examination allows precise determination of the compression pain threshold before and after the therapy. In conclusion, further research should be carried out on a large group of probands that will allow determination of the time needed to contract or relax the muscle and the number of repetitions required to achieve the best results [20]. As shown in the literature, the algometer test is used to plan and monitor the results of therapy. In the tests carried out, measurement of the compression pain threshold was made using the Wagner FORCE TEN FDX algometer. The measurement error of the device is ±0.3%. Due to the subjectivity of pain sensation it is difficult to determine its intensity with a quantitative scale. In the performed tests, the algometer was used to measure the pain threshold. This method allows precise determination of the place where the pain threshold was increased and enables accurate assessment of the effects of the performed therapy.

**Conclusions**

1. The use of both the Hold-Relax and Contract-Relax techniques had an impact on the change of the compression pain threshold.
2. The use of Hold-Relax and Contract-Relax techniques had an impact on increasing the range of motion in patients with lateral epicondylitis.
3. Further research should be carried out on a larger group of probands. It is also recommended that subsequent studies analyze the duration of contraction and relaxation in both the Hold-Relax and Contract-Relax techniques.

**References**

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