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Original article

# NEUROREFLEX MECHANISMS OF ACTION AS PART OF PHYSIOTHERAPY IN DISTAL HUMERUS FRACTURES IN THE EARLY POSTOPERATIVE PERIOD

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**ABSTRACT:**

Of the large joints in the human body, the elbow joint is the most complicated from an anatomical and functional point of view. Its structure and function are such that they make it particularly sensitive to injuries, after which in many cases there is a permanent loss of movement.

Elbow fractures rate is about 5.5% of all musculoskeletal system fractures. The most common are fractures of the radial head (2.8%), followed by those of olecranon (1%) and the distal part of the humerus (0.5%).

Elbow fractures are one of the most difficult injuries to the upper limb to treat and physiotherapy. There are a number of contradictions regarding the most accurate method of treatment and model of recovery, because unlike the shoulder, in the elbow joint even the smallest incongruity in the joint surfaces lead to loss of movement, and prolonged immobilization - to joint contractures. The functional insufficiency of the elbow complex leads to the impossibility of self-service and work.

One-third of the fractures of the elbow joint affect the distal humerus. The mechanism of injury is a fall on a stretched upper limb or a direct blow to the elbow.

**Keyword:** apparatus muscle testing, electronic database, physiotherapy.

## INTRODUCTION

Distal humerus fractures are most often intra-articular, which is why they are accompanied by massive bleeding in the joint, which "drowns" its reference points and makes it difficult to palpate the type of fracture.

Elbow fractures rate is about 5.5% of all musculoskeletal system fractures. The most common are fractures of the radial head (2.8%), followed by those of olecranon (1%) and the distal part of the humerus (0.5%) [1].

The functional insufficiency of the elbow complex leads to the impossibility of self-service and work [2].

Intra-articular transcondylar fractures are the result of high-energy trauma (excluding patients with osteoporotic changes) in the elbow area, often involving soft tissues [3].

The examination shows the patients expression, the characteristic appearance of the elbow joint, which is very painful to the touch. This indicates severe trauma. The configuration of the elbow is deformed; it is enlarged and rounded by the hematoma and the separation of the fragments. Quality x-ray pictures in two projections are informative enough, although some of the details may remain hidden [4].

The forearm is almost always in a pronation position. Intra-articular fractures in the distal part of the humerus are relatively rare [5]. They are usually the result of high-energy trauma and often, especially in young patients, are severe, multifragmentary, open fractures, which are almost always indicated for surgical treatment - surgical adjustment and retention of the achieved reposition with metal implants (usually plaques and screws).

A review of the literature found that the treatment and rehabilitation of fractures of the distal end of the humerus are a complex and debatable problem. It includes the problems of pathoanatomy, the mechanism of injury to the elbow joint, their type and degree of damage, as well as related treatment measures and means of recovery, including the time to start an active movement, the type and volume of special exercises and methods of physiotherapy. This aroused the interest and motivation for the current topic - to clarify the unresolved issues, as well as to enrich the practical work in the physiotherapy of fractures in the distal humerus.

## ORGANIZATION AND METHODOLOGY OF THE RESEARCH

Numerous studies and data on the treatment of fractures in the distal end of the humerus have been published in the scientific literature, but clinical studies for such an important stage of recovery - rehabilitation, are scarce.

In view of this, it is necessary to study the effect of the application of neuro reflex mechanisms of action, as part of physiotherapy, in patients with fractures in the distal humerus, in order to possibly functionally restore the affected limb, affect the pain, and the acquisition of habits for the proper performance of daily physical activities.

The present study aims are to investigate the effect of the application of neuro reflex mechanisms in physiotherapy after fractures of the distal end of the humerus in the early postoperative period.

For this purpose, generalized analysis of the data on the kinesiological and pathokinesiological features of the elbow joint was performed. Neuroreflex mechanisms suitable for inclusion in the early postoperative period in complex physiotherapy after fractures of the distal end of the humerus were selected. The functional effect of the applied methodology for physiotherapy in experimental and control groups of patients was studied, and an analysis of the obtained results was made.

The study was conducted in the period from September 2018 to March 2020. The main criteria for recruiting participants were - surgery with metal osteosynthesis, similar clinical manifestations and lack of complications and comorbidities. According to these criteria, a total of 12 patients were selected and divided into 2 groups of 6 people - control and experimental. The same method of physiotherapy was applied to both groups of patients. In the experimental group, in addition to this method, neuro reflex mechanisms of action were applied. The distribution of patients is as follows - control group 4 women and 2 men, in the experimental - 3 women and 3 men. Each of the patients was conducted a course of 15 physiotherapy procedures performed during the day, starting between 7 and 10 days after surgery.

**RESEARCH METHODOLOGY:**

For the purposes of the study, the results of the following methods for functional diagnostics were reported: goniometry of the elbow joint; evaluation of pain manifestation; testing the tissue resistance at the end of the range of movement; manual muscle testing.

The results of physiotherapy were monitored in the first month after surgery. Initial, intermediate (at the end of the second week) and final (at the end of the fourth week) controls were performed.

The applied methodology allows working work remotely from the place of injury, which makes it extremely suitable for use in the early postoperative period. This reduces pain, reduces muscle spasm and improves blood circulation to the upper limb, which is a solid foundation on which to build a physiotherapy procedure.

In the experimental group of patients, the physiotherapy procedure begins with a segmental massage. For the upper limb, the segment is from C1 to Th5. Its duration is no more than 5 minutes, and the goal is to prepare the tissues for further impact in a neuro reflex way. The most common findings found in patients in the experimental group were increased muscle tone of m.romboideus (major et minor), m.levator scapulae and m.trapecius (pars ascendens). Subsequently, the connective tissue channels are treated. They follow the direction of the 12 main canals (6 for the upper limb). They are believed to provide nutrition to muscles, tendons, joints and bones. Therefore, their treating finds a very good place in the preparatory part of the procedure. They treat pain syndromes, contractures, spasms and muscle atrophy [6, 7, 8].

Pincer-like displacement of the skin to the subcutaneous tissue as well as of the subcutaneous connective tissue to the underlying fascia was applied, although as rule changes were found there mainly in chronic processes with a long history of complaints.

**Fig. 1.** Treatment of acupuncture points

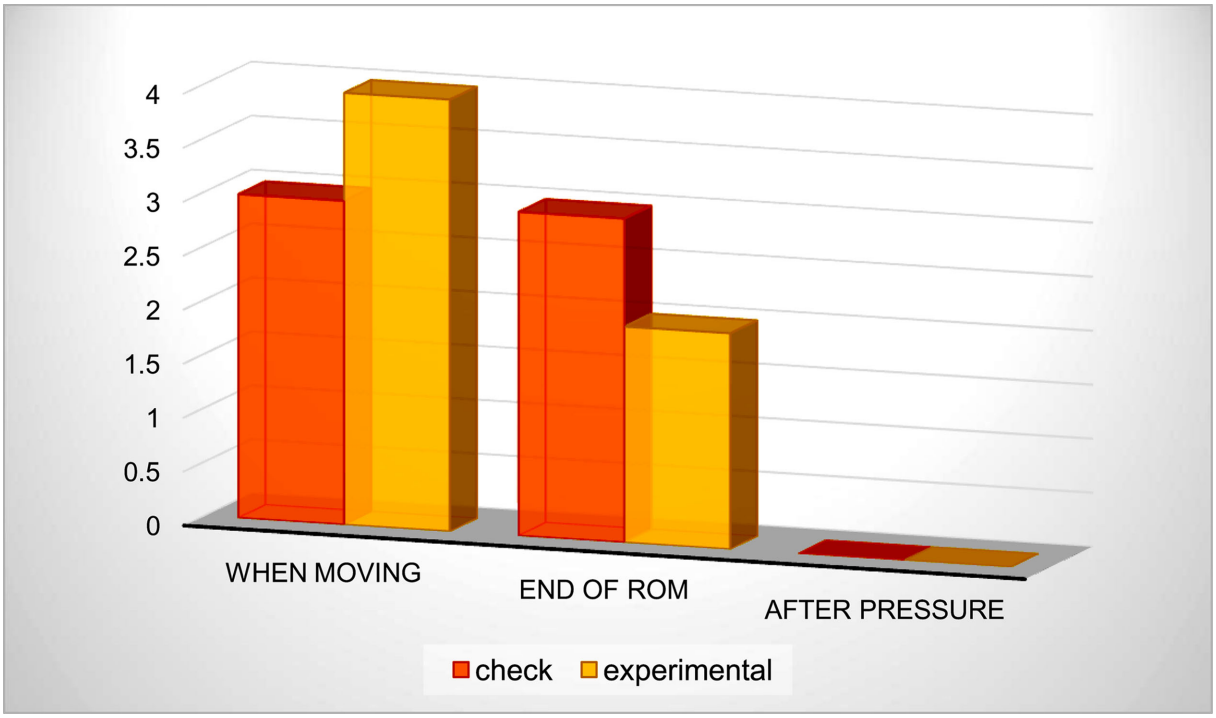
The selection of acupuncture points takes into account the phases of the physiotherapy program. In the most protective period, the points with the topographic location in the area of the elbow joint are not treated. Acupressure begins with a massage of LI4, PE6, SI3,11 and HT1. [9] (Figure 1)

The preparatory part of the procedure in the maximum protective phase ends with acupressure of SI7 and LU10. These points are related to the contractures of the elbow joint, which are the main problem to be solved. That is why it is extremely important to include methods for their prevention at such an early stage, which is inevitably 7 days after the operation. (Graph. 1)

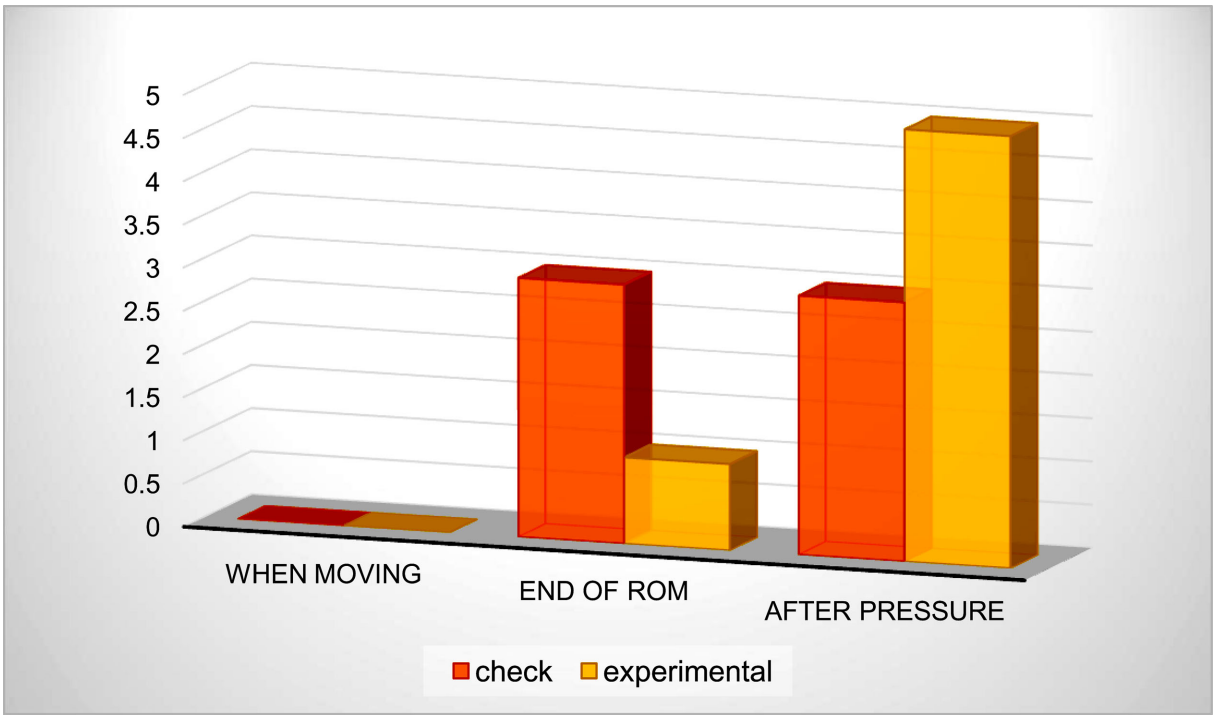
In the moderately protective period, biologically ac-

tive points located on and in the immediate vicinity of the elbow were included. Of the pain-reducing points in the treatment scheme, only MS4 and PE6 were left, as well as SI7 and LU10, related to the contracture of the elbow joint. LI10, 11, HT3, E3, LU5, SI8 and TW10 were added respectively. [10] (Graph. 2)

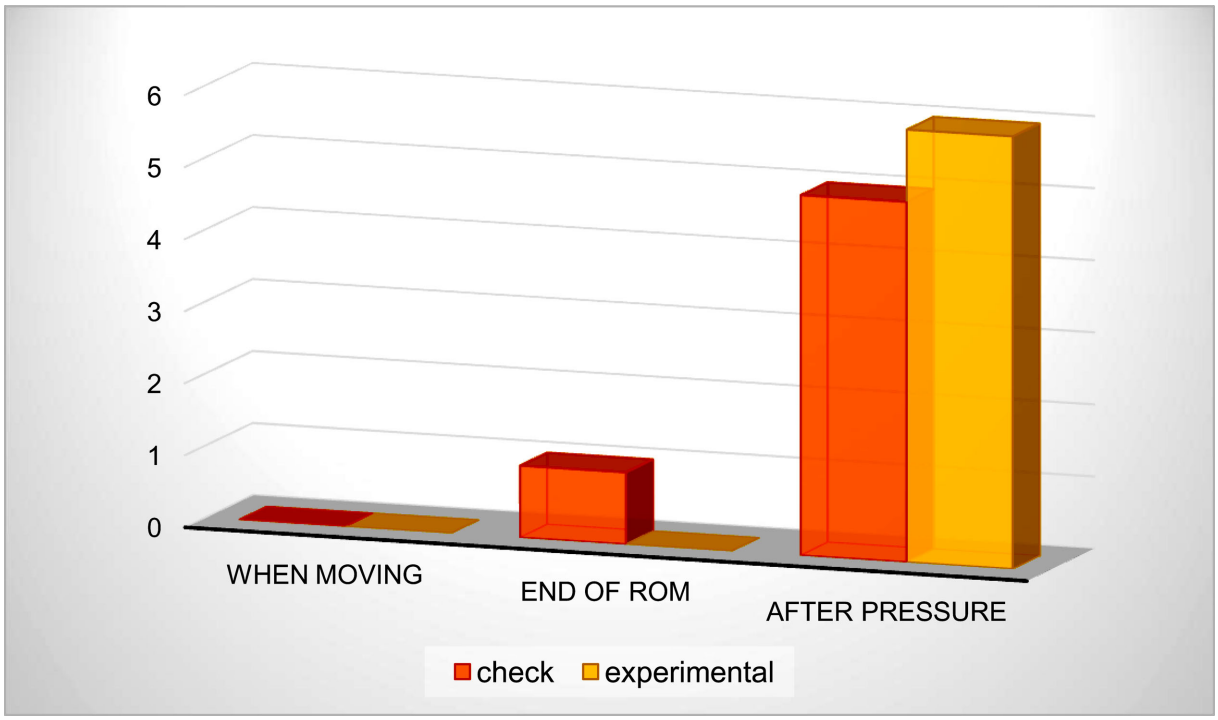
**Graph. 1.** Pain manifestation in the initial examination




**Graph. 2.** Pain manifestation in intermediate examinations



**Graph. 3.** Pain manifestation in the final examinations

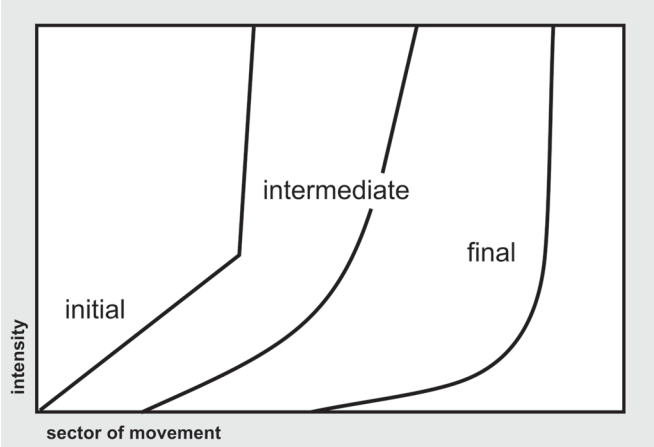



Pain on movement was found in both groups of patients: 4 - experimental, 3 - control. In the rest of the subjects, the pain was at the end of the possible range of motion (ROM): 2 experimental, 3 - control, and the slight predominance of pain in the patients of the experimental group is noteworthy.

Gradually, along with the increase in the possible range motion, the pain symptoms shift to the extreme sectors of the possible movements in the sagittal plane and the pronosupination of the forearm and in the intermediate examinations in most patients in the experimental group, the presence of pain was reported only after additional pressure, while in the control group in 3 patients pain was detected in the last degrees of the possible range of motion. The inclusion of neuro reflex techniques distant from the place of injury at such an early stage gives its positive results. (Graph. 3)

In the final examination of the nature of pain symptoms in all patients in the experimental group, the pain was reported only when applying passive pressure at the end of the movements, and in control, in one patient there is still pain at the end of the possible ROM.

**Graph. 4.** Changing of tissue resistance




The shape of the curves shows eloquently about the change in tissue resistance during the various stages of the study. (Graph. 4)

The steep nature of the curve in the initial examinations shows the appearance of a protective stop at a very early stage of the range of movement, which indicates the presence of a reflex pain guard of the muscles. Interim examinations showed a significant reduction in tissue resistance, with the protective stop now soft, suggesting that there was no longer a reflex pain guard. In the final examinations, an even steeper right part of the tissue resistance curve was found, which indicates that the soft tissues have healed enough to take the load.

The initial results of the measured ***flexion*** in both groups of patients show low and non-functional values. The initial data in both groups of patients are close, which is a good basis for proper analysis of the final results (68.3

control and 65.83 experimental). Intermediate results showed improvement in mean flexion in both groups of patients. Here, the statistics already show a better recovery in the experimental group by 90.83° compared to 83.3° in the control group. The inclusion of techniques at such an early stage distant from the place of injury gives its results. The mean endpoints were significantly better in the experimental group of patients (120°), due to the effect of the inclusion of additional points in the area of the affected joint. In the control group, the mean value in the final results was 99.16°.

The initial results of extension measurements in both groups of patients showed low and non-functional values, as was found at flexion. Similar extensions were obtained in both groups of patients, which is a good basis for proper analysis of the final results. Intermediate results showed an improvement in mean extension by 7.5 ° in control and 11.87 ° in the experimental. The difference between the two groups is not significant but is an indicator of the impact of the applied experimental methodology. The mean endpoints were significantly better in the experimental group of patients, due to the effect of the inclusion of additional points in the area of the affected joint. In the experimental group, the mean deficit relative to the maximum extension measured in the final examination was 19.16° versus 27.5° in the control group.

The initial results of pronation measurement in both groups of patients are similar - about 55°. The mean intermediate results show improvement in both groups of patients, and here in the experimental one, the improvement is better (16.67° compared to 9.16° in control one), thanks to the use of the neuro reflex mechanisms of action. The mean endpoints were significantly better in the experimental group of patients, due to the effect of the inclusion of additional points in the area of the affected joint. In the experimental group, the mean final results reached 83.33° compared to the mean values of 72.5° found in the control group of patients.

The initial results from the measurement of supination in both groups of patients were lower in comparison with the pronation - 47.5° in control and 49.16° in the experimental one. The mean intermediate results showed twice better improvement of the experimental group (by 10°) compared to the control group (by 5°). The mean endpoints show a maintenance rate of recovery and are better in the experimental group of patients, due to the effect of including additional points in the area of the affected joint. In the experimental group, the mean final results reached 83.33° compared to the mean values of 73.33° found in the control group of patients.

**RESULTS OF MANUAL MUSCLE TESTING (MMT)**

MMT performed in the final examinations showed marked improvement, with no significant difference between the two groups of patients. The best estimates in the final examinations were found in flexors and pronators. The estimates found for extensors and supinators are relatively lower. Extensors are generally the weaker muscle group in the elbow. The supinators recover more slowly due to their direct trauma during the operation.

Despite the improvement of the results in the final tests of muscle strength, it should be borne in mind that complete recovery is not possible for this period and this remains a task for the next phases of physiotherapy. In the final stage of the treatment, after we have achieved the recovery of the active range of motion in the joint, we direct the patients to sports activities like swimming and gym exercises and - in instances of professional athletes – a return to their respective sport. [11]

**CONCLUSIONS:**

Analytical assessment of pain manifestation and tissue resistance are functional indicators, according to which the type and methodology of physiotherapy can be very accurately determined in the maximum and moderately protective phase of physiotherapy after surgical treatment of distal humerus fractures. Neuroreflex mechanisms of action are an effective treatment method that is successfully combined with other tools of physiotherapy. The application of neuro reflex techniques leads to accelerated and complete recovery of joint mobility after fractures of the distal part of the humerus. Muscle strength cannot be fully restored for a four-week period of physiotherapy after distal humerus fractures.

Neuroreflex mechanisms of action allow work away from the place of injury, which increases the arsenal of physiotherapy, especially in the early postoperative period, where the pain is a major obstacle to mobilizing the body's restorative forces.

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