https://doi.org/10.5272/jimab.2025311.6013

Journal of IMAB
ISSN: 1312-773X
https://www.journal-imab-bg.org

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Journal of IMAB. 2025 Jan-Mar;31(1)

Original article

THE EFFECTS OF A PHYSIOTHERAPEUTIC COMPLEX IN PATIENT WITH POST-TRAUMATIC STIFF ELBOW

Petar Petkov[1], Detelina Nedyalkova-Petkova[2], Evgeniya Vladeva[2], Liliya Panayotova-Ovcharova[2], Stoyan Ivanov[1]

1) Department of Orthopedics and Traumatology, University Hospital St. Marina -Varna, Faculty of Medicine, Medical University, Varna, Bulgaria.

2) Department of Physiotherapy, Rehabilitation and Thalassotherapy, University Hospital St. Marina -Varna, Faculty of Public Health, Medical University of Varna, Bulgaria.

ABSTRACT:

Elbow stiffness is a relatively common condition and represents a significant disability. A proper clinical history is essential for therapeutic surgical or non-surgical planning.

Purpose: The study aims to investigate the possibility of treating and preventing elbow stiffness.

Material and Methods: A 63-year-old woman was diagnosed with a fracture of the distal humerus and a fracture of the olecranon process. The fractures were treated in the prone position and with a dorsal approach to the elbow. The distal humerus was fixed with medial and dorsolateral locking plates, while the olecranon process was fixed with Webber osteosynthesis. After the operation, the woman required postoperative soft immobilisation for about 30 days. A seven-day treatment was conducted using a combination of Multiwave Locked System (MLS) laser therapy and kinesiotherapy techniques.

Results: On day 1 /T1, after physical examination, the patient was diagnosed with significantly limited range of motion, pain at the end of motion, and swelling of the elbow. On day 7 /T2/ of the seven-day rehabilitation treatment cycle, we observed significant improvement in elbow contracture, range of flexion, reduced swelling, VAS scores, and Mayo Elbow Performance Index scores.

Conclusions: The reported improvement in all the monitored indicators gives us reason to conduct a study on the application of a therapeutic protocol in patients with orthopedic implants of the elbow joint. The challenge in the treatment of postoperative contracture with limitation of movement in the elbow joint requires the inclusion of modern physiotherapeutic methods in its complex treatment.

Keywords: elbow stiffness, elbow fracture, Multiwave Locked System (MLS) laser therapy, kinesitherapy, cryotherapy,

INTRODUCTION

The function of the upper extremities is highly dependent on the movement of the elbow to position the hand appropriately in space. Loss of this movement due to stiffness following trauma can lead to significant dysfunction in patients, resulting in difficulties in performing activities of daily living. Post-traumatic elbow stiffness is difficult to treat, so prevention is of paramount importance [1].

In this case report, we aim to outline the critical aspects of rehabilitation of elbow fractures using a combination of Multiwave Locked System (MLS) laser therapy and kinesiotherapy over seven days.

Elbow fractures account for 4.3% of all fractures, often resulting in stiffness and significant functional impairment. Multiple literature sources indicate that elbow contracture after trauma or surgery develops in 4 stages including haemorrhage, edema, formation of granulation tissue, and subsequent fibrosis [2]. The limited function of the elbow joint often makes activities of daily living such as eating, dressing, and hygiene more difficult [3].

From a biomechanical point of view, the elbow joint has two movement axes–flexion-extension in the frontal plane and pronation-supination in the transverse plane. Studies have shown that the range of motion in the flexion-extension plane is from 0° to 140°; the measured degrees may vary depending on the physiological data of the patients [4, 5].

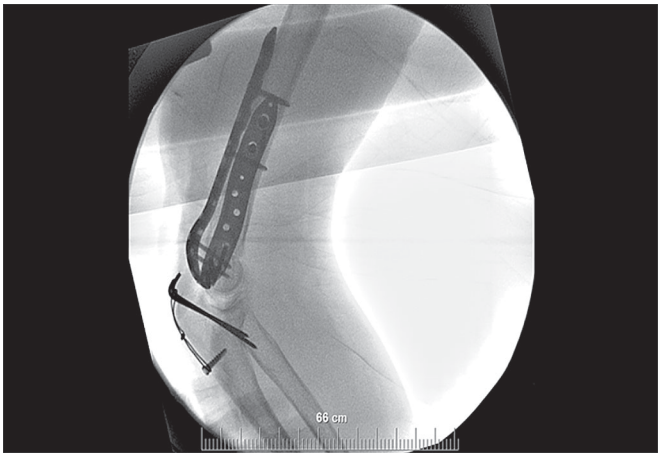
Rehabilitation is typically used to restore range of motion and function. However, there is no established standard for elbow fracture rehabilitation practices. After undergoing surgery, rehabilitation plays a crucial role in determining whether a limb will regain its full functionality or suffer from persistent functional impairment. Our objective is to regain movement and functionality through application of physiotherapy treatment [6].

MATERIALS AND METHODS

A 63-year-old woman was diagnosed with a fracture of the distal humerus and a fracture of the olecranon process. The fractures were treated in the prone position and

with a dorsal approach to the elbow. The distal humerus was fixed with medial and dorsolateral locking plates, while the olecranon process was fixed with Webber osteosynthesis. After the operation, the woman required postoperative soft immobilisation for about 30 days (Fig. 1).

Fig. 1. Postoperative CT image of a 63-year-old female patient. The distal humerus is fixed with medial and dorsolateral locking plates and the olecranon process with the Webber osteosynthesis.



Symptoms were measured at the beginning of the postoperative period, before the start of therapeutic rehabilitation, after removal of soft immobilisation (T1) and after completion of seven days of therapeutic rehabilitation (T2) at the Physiotherapy and Rehabilitation Clinic of "St. Marina" Hospital - Varna. The patient received seven treatments with MLS laser therapy and selected kinesiotherapeutic methods.

- Girth measurements /with a tape measure/
- Mayo Elbow Performance Index questionnaire is an instrument used to test the limitations caused by pathology of the elbow during activities of daily living [7]
- Pain rating scale - visual analogue scale /VAS/ [8]
- Range of motion /ROM/

Comparing elbow flexion and extension with the healthy side is essential to properly assess elbow flexion and extension (Fig. 2 and Fig. 3). Healthy individuals typically have a maximal flexion range of 140° to 150° and a maximal extension range of -10° to 10°, although this can vary based on age and sex [9].

Fig. 2. Elbow extension

Fig. 3. Elbow flexion

Multiwave Locked System (MLS) is a type of class IV near infrared laser with high power and two simultaneous wavelengths or so-called. two-photon effect. The MLS M6 laser therapy device is equipped with both a robotic multi-diode head capable of automatic scanning and a handpiece designed to perform manual point-to-point or scanning procedures. Research on the effects of MLS lasers shows the possibility of immediately influencing the pathogenesis of complications and the possibility of using therapeutic lasers in every phase of rehabilitation after placing metal implants. Several scientific publications about applied treatment with MLS lasers prove a significant decrease in pain and an increase in mobility in the treated joint. In other studies using MLS laser emission proved its anti-inflammatory effect, as well as that it can lead to structural and functional changes in the cell membrane. During treatment with MLS, the balance of metabolism is shifted towards cell differentiation and faster recovery of muscle tissue lesions, muscle hypertrophy is affected, and improved organization of collagen fibres in tendons is observed [10-15].

The MLS® M6 (ASA srl) device was used before the kinesitherapy program (Fig. 4)

Fig. 4. MLS therapy on the operated elbow

Each therapeutic procedure consists of two stages: scanning the elbow area of 150 cm² with a robotized multi-diodic head and treating the trigger points with the manual handpiece applicator in 5 points of 3.14 cm² with a total area of 21.98 cm². The frequency is 700 Hz, the Intensity is 50 %, and the Mean Power is about 1W for scanning and 0.3 W for point-to-point. The time is 10 min for scan and 4 min for point-to-point. The energy is 600.360 J for scanning and 72.048 J for point-to-point. The Energy Dose is 4.00 J/cm^2 for scanning and 4.59 J/cm^2 for point-to-point (Table 1).

Table 1. MLS therapy protocol used.

Application Mode	Frequency (Hz)	Intensity (%)	Mean Power (W)	Total Area (cm2)	Time (min)	Energy (J)	Energy Dose (J/cm2)
Scanning - Robotized multi-diode head	700	50	~1	150	10	600.36	4
Point-to-Point - Manual handpiece	700	50	0,3	21,98	4	72.048	4.59

Kinesitherapy: Once the immobilisation has been removed, relaxation exercises are performed. Cryotherapy and relaxation exercises are used for the biceps brachii and brachioradialis muscles, as well as mobilisation of the elbow joint from the supine position: active exercises, relaxation techniques and facilitating techniques of proprioceptive neuromuscular facilitation (PNF). Passive exercises, stretching, thermotherapy or forced exercises are not recommended [16].

RESULTS:

Statistical analysis of the assessment indicators at the Baseline (T1) and at the end of the treatment (T2).

On day 1 /T1/, after a physical examination, the patient was diagnosed with severely limited range of motion, end-of-motion pain, and edema of the elbow.: 50° elbow contracture, only 80° flexion range The injured elbow joint has a circumference that is 5 cm greater than the healthy elbow joint. VAS - 70 mm Mayo Elbow Performance Index questionnaire 24/100 points. On day 7 / T2/ after completing the seven-day rehabilitation therapeutic course, we registered a significant improvement: 40° elbow contracture, 100° flexion range and 3 centimetres of swelling in comparison to the unaffected side, 40 mm VAS, Mayo Elbow Performance Index questionnaire 63/100 points (Table 2).

Table 2. Results of the traceable parameters for two-time points

Application Mode	**Mayo Elbow Performance Index**	**Elbow circumference difference L<D(cm)**	**Changes in the range of motion of elbow - extension (°)**	**Elbow flexion (°)**	**Spontaneous VAS pain (mm)**
T1	24/100 bad score	5	50	80	70
T2	63/100 average score	3	40	100	40

Before physical therapy, the patient scored 24/100 points on the Mayo Elbow Performance Index questionnaire, which corresponds to a poor result. After the completion of the seven-day therapeutic course, the patient noted an improvement, with the values rising to 63/100, marking positive trends in the physiotherapy treatment of elbow stiffness (Fig. 5).

After completing the therapeutic course for seven days (T2), the edema of the elbow joint is reduced. Elbow circumference difference L<D (cm) is reduced from 5 to 3 (Fig. 6)

Fig. 5. Mayo Elbow Performance Index before and after therapy

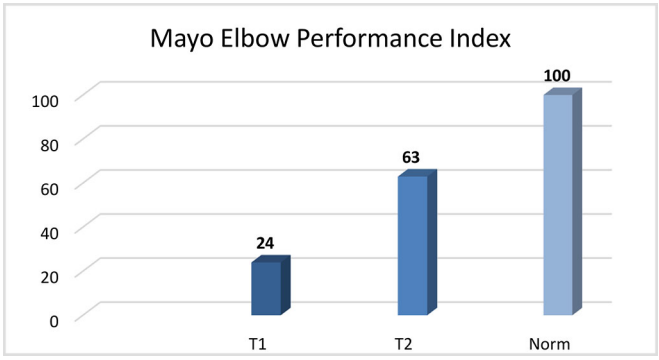
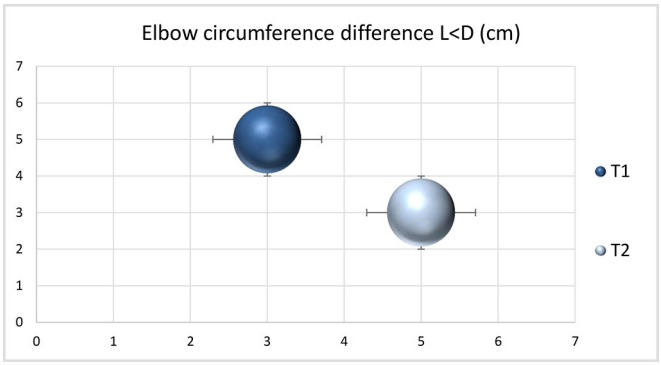


Fig. 6. Elbow circumference difference before and after therapy



After completing the therapeutic course for seven days (T2), the contracture of the elbow joint is reduced- from 50° to 40°, and the flexion of the elbow joint is increased- from 80^0 to 100° (Fig. 7 and Fig. 8).

Fig. 7. Changes in the range of motion of the elbow before and after therapy – extension

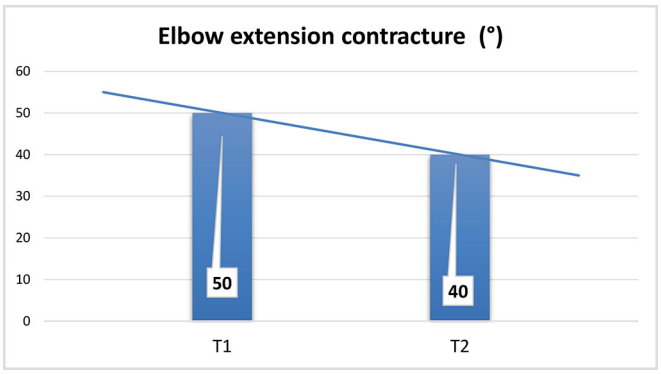
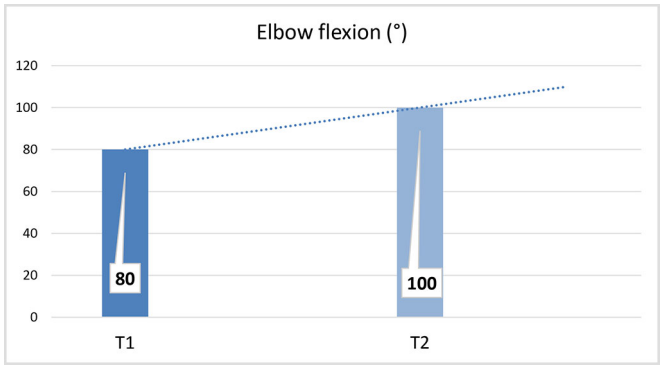
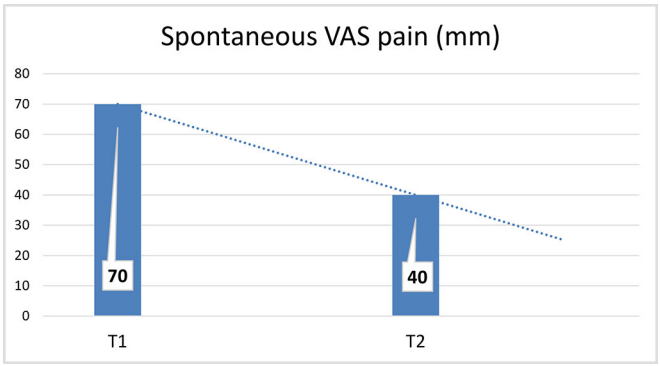


Fig. 8. Changes in the range of motion of the elbow before and after therapy – flexion



A significant reduction in VAS pain was observed. These results once again demonstrate the therapeutic efficacy of appropriate physiotherapy treatment in the treatment of swelling, reduced mobility and subjective pain perception (Fig. 9).

Fig. 9. Spontaneous VAS pain before and after therapy.



DISCUSSION:

The provided data demonstrates a significant improvement in the patient's elbow condition following a seven-day physiotherapy intervention.

Baseline (Day 1/T1):

- Severe elbow contracture (50°)
- Limited flexion (80°)
- Substantial oedema (5cm)
- High pain level (VAS 70mm)
- Poor functional status (MEPI 24/100)

Post-Treatment (Day 7/T2):

- Marked reduction in elbow contracture (50° to 40°)
- Increased flexion range (80° to 100°)
- Decreased edema (from 5 cm to 3 cm)
- Substantial pain reduction (VAS 70 mm to 40 mm)
- Improved functional status (MEPI 24/100 to 63/100)

We explain the positive changes with the anti-inflammatory and pain-relieving effect of laser treatment. The laser light helps to reduce inflammation, which is often the cause of pain and limited mobility. The production of endorphins – the body's natural painkillers – is stimulated. Blood flow to the treated area is increased, which accelerates healing and reduces swelling. The function of fibroblasts, which are responsible for the synthesis of collagen and elastin, the main components of connective tissue, is stimulated. This leads to an acceleration of tissue regeneration and an improvement in elasticity. MSL laser treatment has an anti-oedematous effect, reduces capillary permeability, improves tissue elasticity, stimulates regenerative processes and accelerates the recovery of damaged tissue, reduces contractures, which leads to an increase in the range of motion in the joint.

The inclusion of passive stretching, active and actively supported exercises, specific exercises to strengthen the muscles of the shoulder, forearm and wrist, mobilisation techniques and proprioreceptive neuromuscular facilitation techniques in the rehabilitation programme leads to an increase in the range of motion. These specific techniques and exercises stretch shortened muscles, tendons and ligaments, gradually increasing flexion and extension of the elbow. This leads to a reduction in pain by improving blood circulation, reducing muscle tension

and stimulating the body's natural pain relief mechanisms. At the same time, coordination and function of the affected hand improve. Through functional exercises, the synergy of the muscles involved in the movements of the elbow is restored, making it easier for the patient to carry out their daily activities.

CONCLUSION/S/

The physiotherapy treatment was extremely effective in treating the stiffness, pain, swelling and overall function of the patient's elbow. The observed improvements in range of motion, oedema, pain and functional status are objectively proven and clinically significant.

The study is still in progress and has not reported any long-term results. However, our team does provide a repeat treatment course with an update of the rehabilitation after three months. Additionally, we plan to conduct a longer follow-up of up to six months after the placement of orthopaedic implants.

The reported improvement in all the monitored indicators gives us reason to conduct a study on the application of a therapeutic protocol in patients with orthopedic implants of the elbow joint. The challenge in the treatment of postoperative contracture with limitation of movement in the elbow joint requires the inclusion of modern physiotherapeutic methods in its complex treatment.

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Please cite this article as: Petkov P, Nedyalkova-Petkova D, Vladeva E, Panayotova-Ovcharova L, Ivanov S. The Effects of a Physiotherapeutic Complex in Patient with Post-traumatic Stiff Elbow. *J of IMAB.* 2025 Jan-Mar;31(1):6013-6017. [Crossref - https://doi.org/10.5272/jimab.2025311.6013]

Received: 16/08/2024; Published online: 18/01/2025

Address for correspondence:
Petar Petkov
Department of Orthopedics and Traumatology, Faculty of Medicine, Medical University -Varna
55, Marin Drinov Str., 9002 Varna, Bulgaria.
E-mail: drpeturpetkov@gmail.com