

Laser Therapy in the Comprehensive Program of Physical Rehabilitation of Athletes with Chronic Patellar Tendinopathy

Laseroterapia w kompleksowym programie rehabilitacji fizycznej sportowców z przewlekłą tendinopatią rzepki

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SUMMARY

Aim: Determining the effectiveness of the developed comprehensive physical rehabilitation program for athletes with chronic patellar tendinopathy.

Materials and Methods: Participants were randomly divided into the main and control groups consisting of 11 people each. The complex rehabilitation program in the main group combined laser therapy and different types of therapeutic exercises, in the control group the laser therapy was excluded. The effectiveness of the intervention was evaluated by the intensity of pain in the patella (Visual Analog Scale) and the functional ability of the knee (VISA-P scale).

Results: At the end of the intervention, a significant reduction in pain was observed in both groups. The average scores on the VAS scale were reduced to 2.0 points in the main group and to 3.5 in the control one. The share of patients, whose pain was eased, was 27.27 per cent in the main group, in the control group such people were not detected. After two months of intervention according to the results of the VISA-P scale in both study groups, there was an improvement in the functional capacity of the knee joint. Thus, the average number of points increased by 30.5 points in the main group, and by 12.0 in the control one.

Conclusions: The use of high-frequency laser therapy in a comprehensive program of physical rehabilitation of patients with patellar tendinopathy shows better results for reducing pain and improving the functioning of the knee joint than without it. We believe that high-frequency laser therapy can be used as an important adjunct to various types of therapeutic exercises in the comprehensive rehabilitation of patients with patellar tendinopathy.

Key words: high-frequency laser therapy, exercise, jumper's knee

Słowa kluczowe: laseroterapia wysokoczęstotliwościowa, ćwiczenia, kolano skoczka

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INTRODUCTION

Knee injuries are the most common among sports injuries of the lower extremities in athletes of various sports. This is due to the high load on the joint when jumping and running in training and competition and to the features of the anatomical structure and biomechanics of movements in the knee joint [1-3]. The most common among the types of lower extremities tendinopathy is patellar, especially among elite athletes [4-6]. Signs of patellar tendinopathy can appear after the end of a sports career, and among people who are professionally involved in significant physical activity, and among those who are at risk of developing tendinopathy due to the peculiarities of the connective tissue. Nowadays, it is

believed that this disease occurs due to microtrauma of the tendon-ligament apparatus, which leads to changes in cells and destruction in the extracellular matrix [7].

The main problem of patellar tendinopathy is pain during exercise, but there is still no clear evidence of the aetiology and mechanisms of this pain. And this leads to the existence of different approaches to the treatment and physical rehabilitation of patients with patellar tendinopathy (PT). In physical rehabilitation programs, therapeutic exercises are most often combined with either extracorporeal shock wave therapy [8] or with platelet-rich plasma (PRP) injections or with steroid injections [9, 10]. There are works devoted to the study of low-intensity laser therapy (LILT) or high-

intensity laser therapy (HILT) in tendinopathy [11, 12], the combined effects of laser therapy, and certain types of therapeutic exercises [11, 13, 14] in patellar tendinopathy. No work has been found that studies the combination of laser therapy with different types of therapeutic exercises in one rehabilitation program.

AIM

To substantiate and develop a comprehensive physical rehabilitation program for athletes with chronic patellar tendinopathy, combining different types of therapeutic exercises and high-frequency laser therapy, and experimentally test its effectiveness.

MATERIALS AND METHODS

The study protocol meets the requirements of European bioethics and bio-rights approved by the Helsinki Declaration of the World Medical Association (2008). Written informed consent was obtained from each participant before the start of a comprehensive physical rehabilitation program. The study was conducted from June to September 2021.

The study involved 22 people, all men aged 20 to 35 years. Participants were selected according to the following criteria:

- morphological changes in the tendon confirmed by ultrasound;
- complaints of pain (painfulness) in the lower pole of the patella for at least 2 years;
- presence of conservative treatment in the anamnesis, which did not give a positive result;
- at least an intensive 6-year term of sports;
- availability of sports training or end of sports career not more than a year ago;
- absence of other injuries and diseases of the lower extremities.

Study participants are engaged in athletics (5 people), handball (6 people), football (10 people), basketball (1 person). Participants were randomly divided into two groups of 11 people: the main group, whose participants performed a comprehensive program of physical rehabilitation in full (laser therapy and therapeutic exercises), and the control group, whose participants performed only therapeutic exercises.

The general characteristic of participants of the complex program of physical rehabilitation is given in Table 1.

The comprehensive rehabilitation program for the main group included laser therapy, various types of therapeutic exercises, post isometric relaxation for the muscles of the lower extremities. The control group was engaged in a similar program, but without laser therapy. The program included four stages with a total duration of 2 months.

A high-intensity BTL-6000 laser (P6000.402) with a maximum power of 12 W in the constant mode and a wavelength of 1064 nm was used for laser therapy. Patients in the main group received laser irradiation of the patellar ligament in two stages over four weeks. The first stage was performed for two weeks, every other day, and included procedures to pain manage the affected area. There were 8 sessions according to the program L-7133 [15] with a power of 10 W, a frequency of 25 Hz, a fill factor (FF) of 25 per cent, a therapeutic radiation dose of 12 J/cm², a duration of 4 minutes, a nozzle size of 30 mm. The procedure began at a distance of 5-7 cm from the area of maximum pain, followed by approaching the centre of the lesion. The second stage was also being performed for two weeks, every other day, and included procedures for biostimulation of the tissues of the patella. Eight sessions were performed according to the program L-7134 [15] with a power of 12 W, constant frequency and fill factor (FF), therapeutic radiation dose up to 140 J/cm², duration of 6 minutes, nozzle size 30 mm. In this phase of treatment, only the area of pathology and adjacent areas were treated.

Characteristics of therapeutic exercises according to the stages of a comprehensive rehabilitation program are shown in Table 2.

The effectiveness of the intervention was evaluated by the intensity of pain in the patella and the functional ability of the knee during normal and sports motor activity. Before and at the end of the comprehensive physical rehabilitation program, pain intensity was assessed on a ten-point Visual Analog Scale; the functional ability of the knee – on the scale of VISA-P [16], Ukrainian version [17].

Data were expressed as mean ± standard deviation. The probability of difference was assessed by t-test. The statistical

Table 1. General characteristics of the main and control groups of athletes with patellar tendinopathy (M ± σ)

Indicators	Main group (MG)	Control group (KG)	The difference between athletes MG and KG
Age, years	26.7±5,43	27.2±5.08	p≥0,05
Height, cm	182.3±7,24	179.17±7.92	p≥0,05
Weight, kg	78.8±12.25	78.0±7,53	p≥0,05
Body Mass Index	22.19±2.27	22.32±2.35	p≥0,05
Number of training session per week	5.7±0.48	5.83±0.39	p≥0,05
Duration of one training session, hours	2.1±0.32	2.13±0.31	p≥0,05
Sports experience, years	9.6±2.63	9.25±2.53	p≥0,05

Table 2. Characteristics of a comprehensive program of physical rehabilitation for patellar tendinopathy for the main group

Nº	Stage	Intervention	Dosage
1	Gentle 2 weeks	HILT of pain management	Program L-7133 [15], every other day, 8 procedures
		Fascial manipulations, post isometric relaxation (PIR) Static exercises in the antigravity position of the patient's body.	Musculoskeletal groups of the lower extremity.
2	Stabilizing 2 weeks	HILT Biostimulation	Program L-7134 [15], 3-4 times a week, 6-8 procedures
		Stabilizing eccentric exercises to restore the pattern of movement. Stretching and strength exercises	1 hour, every day, 12 practices
3	Gentle-training 2 weeks	Integrative kinesiotherapy. Dynamic stretching eccentric exercises on block simulators with the unloading of joints, in initial positions with additional points of resistance without axial loading.	12 sessions, 1-1.5 hours
		PNF-neuromuscular reduction of motor stereotype	1 hour, 6 sessions a day
4	Training, Return to sports 2 weeks	Integrative kinesiotherapy. Complex coordination eccentric and concentric exercises on block simulators, including imitating elements of sports exercises of professional orientation.	12 sessions, 1 hour, every day

significance level was set at $p < 0.05$. All statistical analyzes were performed using the STATISTICA 6.0 package.

RESULTS

At the beginning of the rehabilitation process, the difference in the indicators of the main and control groups on the VAS and VISA-P scales was improbable ($p \leq 0.05$) (Tables 3 and 4). At the end of the intervention, a significant reduction in pain was observed in both groups ($p \leq 0.05$). The average scores on the VAS scale were reduced to 2.0 points in the main group and to 3.5 in the control one. The percentage decrease was 71.01 per cent and 50 per cent, respectively. The proportion of patients who were eased of pain was 27.27 per cent (three people) in the main group, in the control group such people were not detected.

After two months of intervention according to the results of the VISA-P scale in both study groups, there was an improvement in the functional capacity of the knee joint. Thus, the average

number of points increased by 30.5 points in the main group, and by 12.0 in the control one. The percentage increase was 53.14 per cent and 21.0 per cent, respectively.

DISCUSSION

For the correct setting of the goals of our comprehensive program of physical therapy, according to the recommendations of scientists and specialists in physical and rehabilitation medicine, we used the SMART format [18]. Short-term goals were set such as relieving local pain during the day; removal of possible muscle spasms during the first stage of the physical rehabilitation program. The long-term goals of the program were to restore the pattern of movement, recover muscle strength, adapt to physical activity and recovery of physical performance, return to sports. During the first and second stages of rehabilitation, intense physical activity was excluded. In the first stage, the main focus was on pain reduction. The second stage of the program is to restore the pattern of movement, which includes

Table 3. Changes in VAS score before and after rehabilitation in the main and control groups, in points ($M \pm \sigma$)

Group	Before rehabilitation	After rehabilitation	Δ (before – after)
Main group	6.9±0.74	2.0±0.99*„	-4.9
Control group	7.0±0.74	3.5±0.60*	-3.5

* $p \leq 0.05$ – probability of difference before and after rehabilitation

« $p \leq 0.05$ – the probability of the difference before and after rehabilitation between the main and control groups

Table 4. Changes in VISA score of rehabilitation in the main and control groups, in points ($M \pm \sigma$)

Group	Before rehabilitation	After rehabilitation	Δ (before – after)
Main group	57.4±9.37	87.9±7.48*„	+30.5
Control group	57.67±6.12	69.67±4.16*	+12.0

* $p \leq 0.05$ – the probability of the difference between before and after rehabilitation in each group

« $p \leq 0.05$ – the probability of the difference before and after rehabilitation between the main and control groups

the correctness of the exercises under the supervision of a physical therapist and their application in everyday life. The third stage involves the transition from pain and limitation in the movement to the strengthening of the entire kinetic chain and the elimination of motor dysfunction. It covers several factors, including strength, range of motion, joint flexibility, motion control and biomechanics. The fourth stage is final, its main task is to fully restore efficiency and return the patient to sports. However, depending on the complexity of the lesion and the individual characteristics of the disease, some methods of a rehabilitation program may be of prolonged usage and employed at different stages of the training process.

For the selection of therapeutic exercises focused on systematic reviews [19-21 and others] and original articles [22-24].

The results of this study suggest that the combination of therapeutic exercises with high-intensity laser therapy (HILT) has a better effect on the functional capacity of the knee joint and better reduces pain than the use of therapeutic exercises alone. There are studies of the effects of both HILT and low-intensity laser therapy (LILT) on tendon pain. The use of HILT in our study is related to the study of Kaydok E. et al. [25], which showed that the use of HILT is more effective in tendinopathy than LILT.

The effectiveness of a comprehensive physical rehabilitation program in patients with patellar tendinopathy was evaluated on the known and frequently used VAS and VISA-P scales [20, 26]. Both scales assess pain. VAS allows you to assess the effectiveness, and VISA-P – the presence and intensity of pain in various daily and sports movements. It should be noted that laser therapy had a more significant effect on pain intensity. This is evidenced by the percentage range of changes in patients in the main group: on the VAS scale, pain intensity decreased by 71.01 per cent, and on the VISA-P scale – by 53.14. This is also evidenced by a comparison of changes in the VAS scale in the studied main and control groups, 71.01 per cent and 50 per cent, respectively. In addition, the vast majority of patients in the main group (81.8 per cent, 9 of 11 people) noted a short-term reduction or absence of pain during normal motor activity after the first laser therapy.

The results on the functioning of the knee joint on the VISA-P scale confirm the better effect of combining therapeutic exercises with laser therapy than without it. At the end of the study, we had 32.14 per cent higher scores in the survey of patients in the main group compared with patients in the control group. The result on the VISA-P scale increased by an average of 30.5 points. Similar changes were obtained in a study on the use of laser therapy of varying intensity [11, 12].

CONCLUSIONS

The use of high-frequency laser therapy in a comprehensive program of physical rehabilitation of patients with patellar tendinopathy shows better results for reducing pain and improving the functioning of the knee joint than without it. The researchers believe that high-frequency laser therapy can be used as an important adjunct to various types of therapeutic exercises in the comprehensive rehabilitation of patients with patellar tendinopathy.

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Conflict of interest:

The Authors declare no conflict of interest

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Info



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