

ISOMETRIC EXERCISES WITH ELEMENTS POSTISOMETRIC RELAXATION TO ELIMINATE THE KNEE JOINT CONTRACTURE AFTER ARTHROSCOPIC PLASTICS OF ANTERIOR CRUCIATE LIGAMENT

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Annotation. *Purpose:* to determine the efficiency of isometric exercises and post isometric relaxation of character for removal and prevention of contractures and recovery of motor function after arthroscopic reconstruction of the anterior cruciate ligament in the late postoperative period. *Material:* The study involved 22 patients aged less than 40 years. *Results:* The results showed that the level of pain decreased equally in patients of main and control group from 3 to 0 points, the performance difference in the amplitude of the bending of the knee joint during the goniometry in the treatment group was 70° in the control group – 30° and the extension 10° – fixed, reaching 5° hyperextension and not changed in the control group (P < 0.05). *Conclusions:* The use of isometric exercises and post isometric relaxation prevent postoperative contracture of the knee joint. Methods of their application are recommended for use in the comprehensive rehabilitation of patients after arthroscopic plastics anterior cruciate ligament.

Keywords: knee joint, arthroscopy, contracture, isometric exercises, post isometric relaxation.

Introduction

In accordance with the special literary sources knee joint injury amount 50 % of all injuries of the joints [6, 7]. At the same time, damage the ligament apparatus of the knee joint, including anterior cruciate ligament (ACL), up more than 30%. During sport activity this mark rises to 60 % [1, 2, 5].

Regeneration of a damaged ACL is possible only by operation. Postoperatively, often immobilization of the knee joint is used by splint. The analysis of special scientific and methodical literature [1, 2, 3, 6] showed that the average term postoperative immobilization is 4-6 weeks. A sufficiently stable flexion-extension contracture forms in the complete absence during this time which is based on the formation of arthrofibrosis, prolonged weakness thigh and shin, breaking mechanisms and proprioception and trophics. Furthermore, the increase in muscle wasting significantly weakens the stability of the knee joint and it increases considerably the likelihood of re-injury without an appropriate rehabilitation.

According to many native and foreign authors [5, 7, 9, 10], an optimal decision for this situation is the immobilization of the knee joint by functional brace with adjustable angles of movement, which provides the necessary stability and protection of the operated joint doesn't allowed except the movements in it. However, for various reasons (for example: high cost functional brace, comorbidities) using of such immobilizers limited in practice in the postoperative period, in compare with static braces, contributing to the oppression of the injured extremity motor function and elimination of postoperative complications.

Static and dynamic stabilizers provide functional stability of the knee joint. The former includes the ligaments, the second – the muscle [6, 7, 9]. That is why for development of complex therapeutic exercises were chosen isometric exercises because it's considered by most authors [2, 6, 7], firstly, it allows to except an axial load on the joint and ligaments of the operated limb, secondly, it improves an intermuscular coordination, proprioceptive mechanisms and trophic processes. Besides, it is quite easy for an adoption.

Thus, the analysis of special literature suggests that one of the ways to solve the above problem for patients after arthroscopic ACL reconstruction is urgent development and practice of special complexes of therapeutic exercises with using isometric exercises and postisometric relaxation (PIR) in the conditions of immobilization of the limb.

The work is implemented according to the consolidated plan of research work in the sphere of physical culture and sports in 2011-2015 relating to 4.4. "Improving organizational and methodological foundations of programming of physical rehabilitation with dysfunctional disorders in various systems of the human body" (state registration number: 0111U001737).

Purpose, target, materials and methods.

The target of this research was to determine the effectiveness of isometric exercises and PIR for prevention of contractures and recovery of motor function after arthroscopic ACL reconstruction of the knee joint in the late postoperative period.

Objectives:

- Substantiate the possibility of inclusion isometric exercises and PIR in the complex of therapeutic exercises;
- To explore the effect of training on motor recovery of knee function.

Research methods. Theoretical analysis and synthesis of the literature, pedagogical experiment, the method of goniometry, testing, methods of mathematical statistics.

Research organization. In order to research the effectiveness of isometric exercises and PIR, was organized a pedagogical experiment in the rehabilitation department SI "Institute of orthopedics and traumatology NAMS of

Ukraine” in the period since 2012 till 2013. The research involved 22 patients (n = 22) at the age of 40, after arthroscopic ACL replacement, which developed flexion-extension contracture of the knee joint. The reason for its appearance was prolonged immobilization in the postoperative period (from 2 to 6 weeks). 16 women and 6 men were among the patients. The main complaint of patients had significant limitation of motion in the knee joint. All patients were divided into two groups – control and main, 11 persons were in each group. Patients in the control group received full conventional treatment for these cases: physiotherapy (magnetic therapy, EMS, laser therapy, cryotherapy), conducted therapeutic exercises, CPM therapy. In the main group it was except for the prescribed treatment, with patients conducted classes therapeutic exercises using isometric exercises and PIR on the proposed method.

Results.

Patients in both groups, according to the recommendations of the late postoperative period, used a hard brace, which is completely excluded motion in the operated knee joint. Therapeutic exercises for patients in the control group were conducted in brace, and the patients of the main group took off in a time of employment of brace.

Late postoperative period was divided into two parts: I – part: 2-3 weeks after surgery (beginning of loading) and Part II – I: 4-5 weeks after surgery (increasing loads. An axial load on the operated extremity and movement in the operated joint of rehabilitation were limited during whole period.

To assess the effectiveness of the rehabilitation treatment indicators used goniometry (volumes flexion and extension in knee joint), which were measured with a goniometer and anthropometric indicators (volume of the thigh and shin). Pain assessment was performed on a 10-point visual analog scale (VAS).

Given that the patients in both groups had an opportunity to move to full load on the operated extremity, all exercises were performed in a sitting position, lying and standing without support her. Therapeutic exercises were done for 20 minutes, 2 times per a day in the I-st part of the late postoperative period and 3 times per a day – in the II-nd part. The interval was 2 hours between sessions

Methodology of PIR which we were used in the process of rehabilitation was as follows: the muscles relax by their isometric tension in the stretched state for 5-7 seconds, followed by passive stretching during the same time. Repeated 5-6 times, which results in a stable muscle relaxation and pain relief.

In I-st part of the late postoperative rehabilitation (2-3 weeks after surgery) the special attention was spared to the anaesthetic measures and eliminate edema. For this it were used the positional placement limb, cryotherapy, compression bandaging and physiotherapy facilities, such as: magnetic therapy, laser and EMS. Therapeutic exercises began with preliminary acquaintance with the proposed patient exercises and determine individual capabilities to perform them. Further, from the offered exercises picked up those that a patient could execute without effort and pains only. One lesson of therapeutic exercises lasted 20 minutes and included no more than four exercises, which, as they are digested gradually replaced by more complex.

Thus, at the time of completion of this phase, the patient is completely digested and well-performed all the exercises proposed technique.

Since the third week from the moment of operation at the end of every engaging in therapeutic exercises added PIR for the purpose of the initial mobilization of the knee joint and reduce pain it.

In the II-nd part of the late postoperative period (4-5 weeks after surgery) rehabilitation measures were aimed at strengthening and stabilizing the knee joint to provide the necessary support ability of the operated limb during the upcoming walk. Physiotherapy at this stage complement EMS of quadriceps. Hydrocortisone phonophoresis were used of remaining pain syndrome. Therapeutic exercises complicated and complementary exercises with rubber cord, non-elastic tape and fitball. Training sessions were conducted for 20 minutes three times per a day with more frequent changes of exercise. It allowed not only to increase the functional loading but also do therapeutic exercises more various and improve the emotional state of the patient.

Below it is one of the options set of exercises that are used during rehabilitation treatment.

Exercise 1. Starting position: sitting, legs are straight ahead. Isometric tension quadriceps. Hold the position during 7-10 seconds. Repeat 7-10 times;

Exercise 2. Starting position: the same. Ball is between the thighs. Compress the ball hips with maximum retention of muscle tension during 7-10 seconds. Repeat 7-10 times;

Exercise 3. Starting position: lying on the back. Heels are on a roller. With support on heels and shoulder-blades, to heave up a pelvis. Hold the position during 7-10 seconds. Repeat 7-10 times;

Exercise 4. Starting position: lying on the stomach, socks still are on the roll, hips are on the floor. Drawing on socks straight legs at the knee joints, raise your pelvis. Hold the position during 7-10 seconds. Repeat 7-10 times;

Exercise 5. Starting position: standing. A rubber band is fixed on the wall bars. Hold the foot, straight leg raise to the maximum tension. Hold the position during 7-10 seconds. Repeat 7-10 times. Exercise is carry out in all directions – abduction, flexion, extension;

Exercise 6. Starting position: the same. A leg is arcuated in a knee joint at an angle of 15-20°. Hold the tape foot, lift the bent leg up to the maximum tension. Hold the position during 7-10 seconds. Repeat 7-10 times. Exercise is carry out in all directions – abduction, adduction, flexion, extension .

Exercise 7. Starting position: standing. Stiff tape fastened to the wall bars and ankle. A leg is arcuated in a knee joint at an angle of 15-20°. Hold the tape foot, lift the bent leg up to the maximum tension. Hold the position during 7-10 seconds. Repeat 7-10 times. Exercise is carry out in all directions-abduction, adduction, flexion, extension;

Exercise 8. Starting position: standing . Stiff tape fastened to the wall bars and ankle. Raise a straight leg to the maximum tension and hold during 7-10 seconds. Repeat 7-10 times. Exercise is carry out in all directions – abduction, adduction, flexion, extension.

As a result of rehabilitation, in the both groups – main and control, pain was 3 points early in the late postoperative period, decreased to score 1st in the exercise movements and 0 points alone in the end of the period.

Anthropometric measures and in the main and in the control group by the end of the period have not changed significantly. Swelling of the soft tissues of femur and tibia in both groups decreased to the same extent. At the same time indicators range of motion to the knee joint in the patient groups had differences (Table 1).

Table 1

Goniometry data in the late postoperative period in patients of basic and control group (n = 22)

Research groups						
Indicators	main			control		
	at the beginning of the period	at the end of the period	P	at the beginning of the period	at the end of the period	P
Flexion	$30^0 \pm 3^0$	$110^0 \pm 2^0$	< 0,05*	$30^0 \pm 3^0$	$60^0 \pm 3^0$	< 0,05*
Extension	$5^0 \pm 2^0$	$-5^0 \pm 2^0$	<0,05	$5^0 \pm 2^0$	$5^0 \pm 2^0$	< 0,05

Note: * P – significance differences in the indices of both groups.

Analysis of indicators of range of motion to the knee joint found that the amount of flexion and extension improved in both groups, but the dynamics of the patients of basic group was better than in the control group (P <0.05).

Conclusions.

Thus, using in the first month after arthroscopic ACL reconstruction isometric exercise and post isometric relaxation in complex of therapeutic exercises is an effective way of preventing postoperative contracture knee joint. The developed method of application of isometric exercises and PIR can be recommended for using in rehabilitation complex for patients with knee joint contractures after arthroscopic anterior cruciate ligament reconstruction.

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