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OPTIMIZATION OF REHABILITATION IN COMBINED MENISCUS KNEE INJURY AND ANTERIOR CRUCIATE LIGAMENT IN SPORTSMEN

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ABSTRACT

The article analyzed the data of 84 sportsmen of various qualifications who were at the postoperative stage for the restoration of the anterior cruciate ligament and meniscus resection. All study participants were injured while playing sports: football - 50.6%; martial arts - 23.5%; volleyball - 11.8%; weightlifting - 8.2%; athletics 5.9%. The period from the moment of surgical interventions to the recovery stages of physical rehabilitation was 1.6 ± 0.8 years.

KEY WORDS. *Rehabilitation, sportsmen of various qualifications, anterior cruciate ligament, knee meniscus, injury.*

INTRODUCTION

Most often, the cause of knee joint injuries are sports games, which are characterized by high intensity of movements, rapid switching during the game moment, and force load on the body. All this requires high physical fitness from athletes. In the statistics of sports injuries, knee joint injury occupies one of the leading places, which is why this topic is very relevant [8].

The most common diseases of the musculoskeletal system among sportsmen include: bruises, dislocations, sprains, ruptures of ligaments and tendons, muscle ruptures, bone fractures, osteoarthritis. Injuries to the musculoskeletal system occur mainly when an external destructive force acts on various parts of the body or when a certain segment of the musculoskeletal system is overstressed. Bruises, dislocations and sprains are the most common types of injuries [9].

The anterior cruciate ligament is the main component in the kinematics of the knee joint and provides approximately 85% of the total restraining force during anterior translation [1]. It prevents excessive medial and lateral rotation of the tibia, as well as varus and valgus loads (Matsumoto, 2001). Due to the presence of many mechanoreceptors, the anterior cruciate ligament performs a proprioceptive function (Singh, 2020). Therefore, damage to the anterior cruciate ligament is not just an injury to the musculoskeletal system, but a neurophysiological dysfunction of the knee joint [3].

Since the role of the anterior cruciate ligament in the kinematics of the knee joint is very important and when it is injured, instability of the knee joint occurs, a comprehensive program of physical rehabilitation is required (van Melick, 2016). Since injuries of the anterior cruciate ligament are relatively common knee injuries among the sports contingent [2,5,7], recovery measures after this injury today require constant improvement. Indicators such as the patient's age, level of physical activity and subjective symptoms of instability in daily life should be taken into account when developing a phased physical rehabilitation program [4,6].

As practice shows, only physiotherapeutic treatment does not fully restore the amplitude of knee movements, so the question of creating a comprehensive program for strengthening and restoring proprioception and training normal walking remains relevant.

Until recently, the issues of injuries in sports have been insufficiently covered, apparently out of a false fear of discrediting the sport. However, professional sports, like any other kind of work, must be properly studied and socially protected.

For this reason, **the aim of the study** was Evaluation of the effectiveness of complex rehabilitation in combined injuries of the meniscus of the knee joint and anterior cruciate ligament in sportsmen.



MATERIALS AND RESEARCH METHODS

The study analyzed the data obtained by 84 athletes of various male qualifications. Qualification of athletes - candidates of master of sports, master of sports to masters of sports of international class, specializing in such sports as freestyle wrestling, judo, football, volleyball, weightlifting and athletics. All examined patient- sportsmen were at the post-operative stage of restoration of the anterior cruciate ligament and meniscus resection, aged 19 to 34 years, the average age is 26.6±1,8 years. The sportsmen had no previous history of knee injuries. On average, the period from the moment of surgical interventions to the recovery stages of physical rehabilitation was 1.6±0,8 years.

All participants in the study were injured while playing sports: football n = 43 (50.6%); martial arts - n = 20 (23.5%); volleyball - n = 10 (11.8%); weightlifting - n = 7 (8.2%); athletics - n = 5 (5.9%) (Fig. 1).

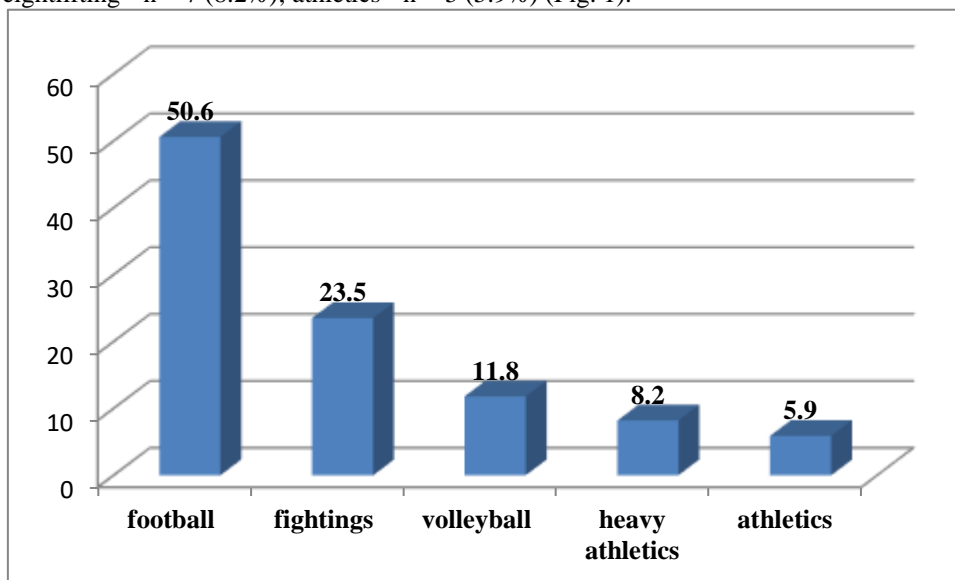


Figure 1. Distribution of sportsmen depending on the sport

All patients were hospitalized, after surgical interventions, in the scope of operations to restore the anterior cruciate ligament and partial or complete removal of the meniscus (meniscectomy). From the total number of sportsmen, depending on the methods of rehabilitation, 2 groups were formed: the main group - 41 patients - on the background of standard therapy, treatment according to the program of rehabilitation measures using physical rehabilitation; control - 44 patients - patients received standard therapy.

RESEARCH RESULTS

The physical development of sportsmen was assessed according to the parameters shown in Figure 2.

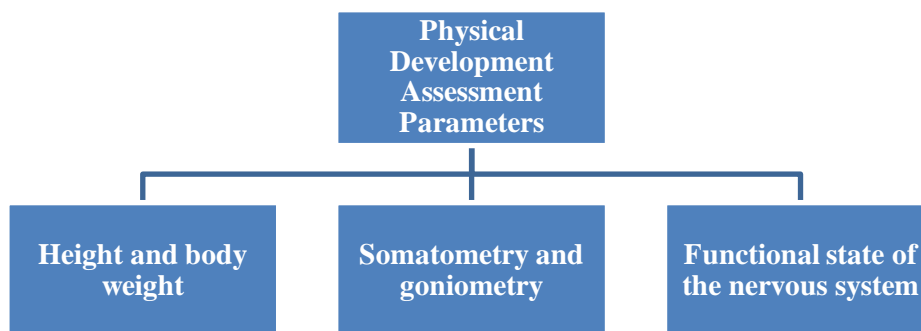


Figure 2. A comprehensive assessment of the physical development of sportsmen

Upon admission, all sportsmen measured height, which in the main group was 174.1±6 cm, and in the control group - 175±6.9 cm. The dynamics of thigh muscles determined the initially pronounced muscle hypotrophy in both observation groups. Table 1 shows



the analysis of somatometry indicators in the study groups before surgery, and in the following observation periods - 7 weeks, 3 months, 6 months (table 1).

Table 1
Analysis of somatometry indicators of the studied sportsmen - patients

Index	Groups		Observation period						
			Before surgery	7 weeks	3 months	6 months	R 1	R 2	ΔM
Circle hips	Main	ZK	41.3 ± 1.1	43.6±0.4	44.7 ± 1.3	47.4 ± 0.8	< 0.001	0.13	12
		OK	40.2 ± 1.2	37.6±0.5	41.7 ± 1.4*	45.5 ± 1.0	< 0.001	0.04	13
Circle hips	Control	ZK	42.2 ± 1.0	43.1 ± 0.7	43.7 ± 0.9	45.3±0.6	0.045	0.12	7.3
		OK	40.3 ± 1.3	39.2±0.6	40.5 ± 0.7*	42.6 ± 1.4	0.06	0.07	6.9
Circle shins	Main	ZK	38.9 ± 1.1	37.1 ± 1.2	40.6±1.0	43.2 ± 0.8	0.003	0.05	12.8
		OK	36.7± 1.4*	32.4 ± 1.3	36.5 ± 1.1*	42.8±0.7*	< 0.001	0.006	19
Circle shins	Control	ZK	36.8 ± 1.2	35.3±1.4	37.7 ± 1.2	39.8 ± 1.3	0.02	0.04	7.3
		OK	34.7 ± 1.2	31.6 ± 1.0	34.6 ± 1.1	37.8 ± 1.4	0.03	0.004	8.7

P 1 - statistical significance of differences in the group (before surgery / 6 months of observation)

P 2 - statistical significance of differences between groups (6 months of observation)

ΔM - growth rate, percentage change in indicators (before surgery / 6 months of observation)

*p<0.05, **p<0.001 – stat. reliability of differences compared to the previous period

ZK - healthy limb; OK - operated limb

As can be seen from Table 1, by 6 months after the surgical interventions, there is a difference in the volume of the thigh muscles (in the main group it was 6.1±1.9 cm, in the control group it was 5.3±1.1 cm). Upon completion of the physical rehabilitation program, there was an increase in muscles in the main group by 13.2% in the healthy limb and 20% in the operated one; in the control group - by 7.7% and 9.9%, respectively (p≤0.05). By 6 months in the main group, the difference between the volumes of the leg muscles was 0.6 ± 1.8 cm and 1.7 ± 2.1 cm.

The obtained results of active flexion of the limb during goniometry were lower than those of the passive one. After 3 months, in most cases, the range of passive movements was completely restored; the volume of active movements of this level was achieved between 5-6 months, 1 month after the operation. By 6 months, the amplitude of active and passive movements was restored in almost all trainees in the main group, which was statistically significantly higher in relation to the indicators of the control group (Fig. 3 and 4).

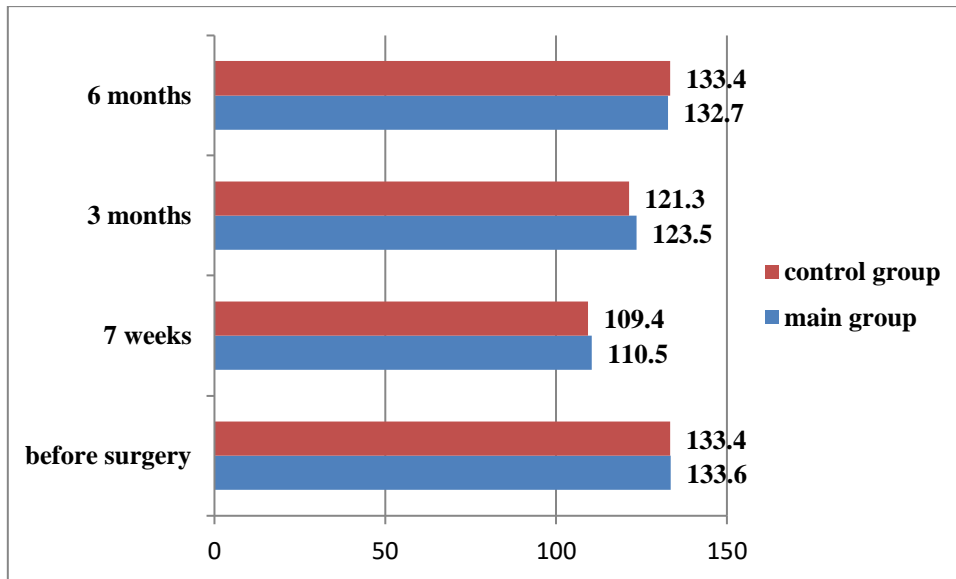


Figure 3. Analysis of indicators of active flexion during goniometry in the group of patient sportsmen.

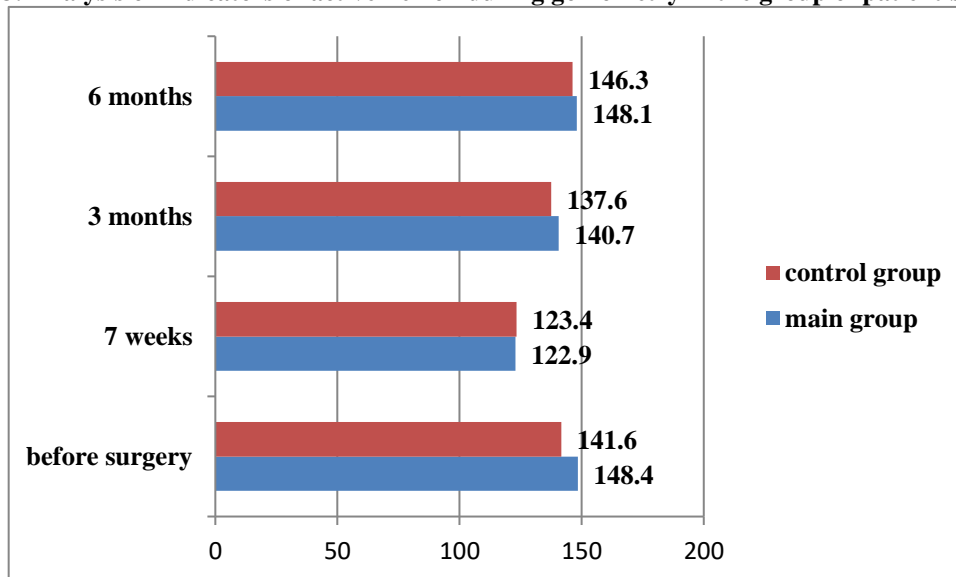


Figure 4. Analysis of indicators of passive flexion during goniometry in the group of patient sportsmen.

As can be seen from Table 2, the indicators of manual muscle testing of the quadriceps muscle in the two groups were almost the same, but by the end of the third month of recovery measures there was a movement, while it was more favorable for the athletes-patients of the main group (the growth rate was 4.6). The obtained results of manual muscle testing further indicate a more effective impact of the developed physical rehabilitation program.



Table 2

Analysis of the results of manual muscle testing (in points) of the quadriceps muscle of the studied sportsmen - patients

Groups	Observation period						
	Before surgery	7 weeks	3 months	6 months	R 1	R 2	ΔM
Main group	2.3±1.2	2.5±2.1	3.1±1.6	4.8±1.1	0.412	0.622	4.6
Control group	2.2±1.4	2.4±1.9	2.6±2.1	3.2±1.4	0.201	0.324	2.8

P 1 - statistical significance of differences in the group (before surgery / 6 months of observation)

P 2 - statistical significance of differences between groups (6 months of observation)

ΔM - growth rate, percentage change in indicators (before surgery / 6 months of observation)

*p<0.05,**p<0.001 – stat. reliability of differences compared to the previous period

During the high-speed force testing, changes were determined in all the studied parameters (Table 3). The highest share fell on the results of the athletes of the main group when performing the zigzag jump test and on overcoming 6 meters on the operated limb, where the increase was 59.3% and 13.2%, respectively. According to all conducted control and pedagogical tests, the results of the limb symmetry index by the sixth month showed over 90%, which indicates the functional restoration of the operated limb.

Table 3

Indicators of speed-strength abilities and stability of the knee joint

Index	Limb	Groups	Observation period			
			3 months	6 months	P1	P2
Jump from places (cm)	On two legs	OG	182±4.8	189±4.7	0.52	0.51
		KG	178.3±5.3	184±5.4	0.48	
Triple jump (m)	ZK	OG	4.8±0.2	5.2±0.1	0.23	0.47
		KG	4.6±0.4	4.2±0.2	0.37	
	OK	OG	3.5±0.2	4.9±0.2	0.54	0.27
		KG	3.4±0.5	4.1±0.4	0.36	
Jump on overcoming 6 meters (s)	ZK	OG	2.2±0.6	2.0±0.2	0.23	0.38
		KG	2.3±0.2	2.2±0.2	0.58	
	OK	OG	2.4±0.2	2.1 ± 0.4*	0.04	0.07
		KG	2.6±0.3	2.5±0.3	0.73	

P 1 - statistical significance of differences in the group (before surgery / 6 months of observation)

P 2 - statistical significance of differences between groups (6 months of observation)

ΔM - growth rate, percentage change in indicators (before surgery / 6 months of observation)

*p<0.05,**p<0.001 – stat. reliability of differences compared to the previous period

ZK - healthy limb

OK - operated limb

The obtained data of the Romberg test (Table 4) by 3 months after the operation determined a significant difference between the parameters of the healthy and operated limbs. By 6 months, it increases between the main and control groups. According to statistical calculations for 6 months, there is a significant difference between the groups at $p \leq 0.05$.



Table 4
The result of the vestibular stability test and the Romberg test

Index	Groups	Observation period					
		7 weeks	3 months	6 months	R 1	R 2	ΔM
Test for vestibular stability, (cm)	OG	8.1 ± 1.1	5.9±1.3	4.4 ± 1.2	0.03	0.52	-47.6
	KG	7.2 ± 1.3	6.9±1.2	7.0±1.3	0.582		-7.7
Romberg test, standing, legs together, (c)	OG	-	> 1 min	> 1 min	-	-	-
	KG	-	> 1 min	> 1 min	-	-	-
Romberg test, leg to leg right forward, (c)	OG	-	> 1 min	> 1 min	-	-	-
	KG	-	> 1 min	> 1 min	-	-	-
Romberg test, leg to leg left forward, (c)	OG	-	> 1 min	> 1 min	-	-	-
	KG	-	> 1 min	> 1 min	-	-	-
Romberg test, standing on the ZK with open eyes, (c)	OG	-	42.8 ± 3.7	55.3 ± 3.9*	0.008	< 0.001	30.5
	KG	-	38.4 ± 2.1	44.6 ± 2.9	0.243		15.9
Romberg test, standing on the ZK with closed eyes, (c)	OG	-	18±1.1	26.8 ± 1.6**	< 0.001	0.012	44.2
	KG	-	13.7 ± 1.2	20.5 ± 1.7*	0.036		38.2
Romberg test, standing on OK with open eyes (c)	OG	-	34.4 ± 3.6	42.2 ± 3.7	0.178	0.062	22
	KG	-	25.7 ± 2.8	30.3 ± 3.6	0.243		15.6
Romberg test, standing on OK with eyes closed, (c)	OG	-	10.4±1.2	20.8+ ± 1.5**	< 0.001	< 0.001	97.3
	KG	-	5.8±0.9	8.9 ± 1.3*	0.006		69.6

P 1 - statistical significance of differences in the group (before surgery / 6 months of observation)

P 2 - statistical significance of differences between groups (6 months of observation)

ΔM - growth rate, percentage change in indicators (before surgery / 6 months of observation)

*p<0.05,**p<0.001 – stat. reliability of differences compared to the previous period

CONCLUSION

Thus, the studies of the level of development of proprioception after a knee joint injury made it possible to identify the problem of the need and possibility of returning the sports contingent to the training process using a physical rehabilitation program, the main purpose of which is not only to restore the functional activity and work of the knee joint, but also to prevent the occurrence of secondary injuries. .

Since the usual methods of physical rehabilitation, including massage and physiotherapy, have a low resolution in the treatment of knee joint injuries, it is necessary to use special programs aimed at restoring soft tissues and joint mobility by restoring motor function based on an adapted anatomical structure.

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