

**NATIONAL SPORTS ACADEMY
“VASSIL LEVSKI” – SOFIA
DEPARTMENT “SPORTS MEDICINE”**



Yani Georgiev Shivachev

**SECONDARY PREVENTION OF SOFT TISSUE
IN THE AREA OF THE KNEE IN ATHLETES**

ABSTRACT

Sofia, 2020

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**SECONDARY PREVENTION OF SOFT TISSUE
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Professional direction 7.4. Public health, doctor
program “Kinesitherapy“

ABSTRACT

Of the dissertation for getting for the educational and
scientific degree “Doctor“

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PhD

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Sofia, 2020

The dissertation contains 110 standard pages and is structured in four chapters. It includes 22 tables, 45 figures and 5 appendices. The bibliography contains 140 sources, 29 of which are in Cyrillic and 111 in Latin.

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ABBREVIATIONS

GDV	Gas discharge visualization
EG	Experimental group
PCL	Posterior cruciate ligament
CG	Control group
KJ	Knee joint
KT	Kinesitherapy
LCL	Lateral collateral ligament
MCL	Medial collateral ligament
MMT	Manual muscle testing
PIR	Post isometric relaxation
ACL	Anterior cruciate ligament
PNF	Proprioceptive neuromuscular facilitation

Introduction

In the scientific space, the reported data on the increase in the frequency of injuries to the soft tissues of the knee against the background of a decrease in the age limit at which they appear are increasing. These injuries include partial or total rupture of the anterior cruciate ligament, meniscus lesion, rupture of the medial collateral ligament, sprains and muscle strains. The causes of these injuries can have different etiologies: improper loading of the knee complex during various physical activities, inadequate course of the recovery process in case of trauma, unhealthy lifestyle and others. Every day the knee complex is subjected to different in strength and size loads involving its static-dynamic components. The knee is a load-bearing structure that takes heavy loads both in locomotor activities and in more specific models of movement. Good muscle balance, ligament apparatus and joint surfaces determine its control and stability, as any soft tissue injury leads to functional disorders of the joint.

In sports practice, the knee is highly vulnerable because it actively participates in sports-specific motor stereotypes. Intra-external and varus-valgus disorders are one of the most common mechanisms for soft tissue damage in this area. They are especially typical in sports such as football, basketball, handball, skiing. In addition to these mechanisms, risk factors play a role in soft tissue injuries of the knee, which can be categorized into two main groups: internal and external. Knowledge of sport-specific motor patterns and risk factors are key to preventing or avoiding soft tissue recurrences in the knee. The identification of risk factors would be possible only by building a

multidisciplinary team of specialists to cooperate for the benefit of the athlete. In this way, an accurate and timely diagnosis would be made with subsequent treatment and prevention of soft tissue injuries in the knee area. Neglecting these injuries of the knee complex can lead to serious consequences, and in persons practicing sports to temporary or permanent cessation of sports activities.

In the complex treatment of injuries of the knee complex the correct individual approach in the preparation of the kinesitherapy program after adequate kinesiological and pathokinesiological diagnostics is extremely important, thanks to which effective treatment and prevention can be carried out. This in turn will lead to better results and meet the expectations of all stakeholders: patient, doctor, physiotherapist.

1. RESEARCH METHODOLOGY

Working hypothesis: Based on the review of the scientific literature and our clinical experience, we believe that if a kinesitherapeutic prevention model is developed, including earlier use of techniques to restore arthrokinematics and soft tissue mobility, the efficiency of the recovery process in sports practitioners with soft tissue injuries of the knee would increase.

1.1. Aim and tasks of the dissertation

Aim: to develop and test our own kinesitherapy methodology for secondary prophylaxis and to evaluate its effectiveness in soft tissue injuries in the knee, involving anterior cruciate ligament in athletes.

Tasks:

1. To assess through a questionnaire, the risk factors for soft tissue injuries in the knee joint in all subjects
2. To study the influence of pain, stiffness, instability, weakness on the motor function of the knee during daily activities as a result of the application of kinesitherapy in the two studied groups
3. To evaluate the influence of pain symptoms as a result of kinesitherapy methods in the subjects of both groups
4. To compare the effectiveness of the two methods in terms of some functional changes - limb circumference, active range of movement in the joint, muscle weakness
5. To summarize the effectiveness of the tested kinesitherapeutic prevention model in soft tissue injuries of the knee

Object: athletes practicing sports with a load on the knee complex, suffered soft tissue injuries of the knee.

Subject: development of author's kinesitherapeutic methodology for athletes practicing sports with loading of the knee complex with soft tissue injuries for optimal functional recovery.

1.2. Material, methods and tools of the research

1.2.1. Material of the research

The scientific research was conducted in MCRSM "Prostor" - Varna, in a gym, in the period July 2016 - July 2017. The study included 60 subjects – 45 football players, 10 basketball players and 5 handball players, after surgery - arthroscopic reconstruction of the anterior cruciate ligament, divided equally into two groups - experimental and control. The 30 subjects were included in the experimental group, and the remaining 30 subjects in the control group all with soft tissue injuries in the knee joint, who underwent surgery and conducted kinesitherapy. The patients from the experimental group took part in our proposed kinesitherapy program, while the subjects from the control group conducted their kinesitherapy according to approved kinesitherapy protocols. All participants in the study had the opportunity to get acquainted with the kinesitherapy program that will be applied to them and previously filled in an informed consent. After the completion of the program, the subjects from both groups - experimental and control, were provided with a kinesitherapy prevention program to follow at a later stage of recovery. The program itself has to do with improving stability and muscle strength in the knee.

1.2.2. Research methods: the following methods were used in the study:

A) Anthropometric methods: centimeter, goniometer, manual muscle testing (MMT).

B) Questionnaire methods: Knee outcome survey activities of daily living scale (ADLS), questionnaire to study the risk factors, visual analog scale

C) Statistical methods: statistical grouping of data, verification of the reliability of the survey using the Cronbach's test, descriptive method, verification of statistical hypotheses, correlation analysis. The statistical product SPSS v.19.0 was used for processing the results.

1.2.3. Research tools

We used a questionnaire to assess the symptoms and the extent to which they affect the knee joint in activities of daily living (ADLS). The survey consists of 12 questions, each of which is marked with one possible answer and answers on a six-point scale: from 0 - "impossible to perform" to 6 - "no difficulty". The total of all answers is 60 points. We also included a questionnaire to study the risk factors that contribute to the occurrence of knee injury. It includes 10 questions with one possible answer, with scores from 1 (lowest score) to 5 (highest score).

Time parameters of the study: the study was implemented in the period July 2016 - July 2017 and was conducted in terms of personal contact of the doctoral student with the participants.

Place of research: the study was performed in MCRSM "Prostor" - Varna, and the interaction was

carried out at the first meeting between the physiotherapist and the patient.

2. Methodology of kinesitherapy

2.1. Aim and tasks of kinesitherapy

The aim of kinesitherapy is to restore the function and stabilization of the knee complex and return to work and sports.

Tasks of kinesitherapy:

1. Reduction of pain symptoms;
2. Increasing the range of movement in the knee;
3. Improving the bio-psycho-social status;
4. Reduce swelling and improve muscle strength in the knee joint;
5. Improving muscle control and balance agonists / antagonists in the knee;
6. Prevention of postoperative contractures in the knee joint;
7. Reeducation in the implementation of activities in daily life.

2.2. Means of kinesitherapy

- Cryotherapy;
- Manual lymphatic drainage;
- Joint mobilization techniques;
- Post isometric relaxation (used only in CG);
- Strengthening gymnastics;
- Exercises with elastic bands (used only in CG);

- Swiss ball;
- Balance board workout;
- Elements of sports;
- Locomotor training;
- Bicycle ergometer;
- Kinesiotape.

2.3. Author's kinesitherapeutic methodology

№	Starting position	Description of the exercise	Duration	Methodical instructions
1	Lying on the back	Cryotherapy	3 min.	Cryotherapy is performed with an ice cube covering different areas of the knee and thigh
2	Lying on the back	Manual lymphatic drainage	10-15 min.	The techniques are performed slowly and rhythmically without force

8	7	6	5	4	3
Lying on the back	Lying on the back	Lying on the back	Lying on the back	Lying on the stomach	Lying on the stomach
Lifting the pelvis on a Swiss ball	Flexion and extension in hip	Dorsal and plantar flexion of the feet	Caudal sliding of the patellofemoral joint	Tibiofemoral joint - dorsal sliding	Distraction of the tibio-femoral joint
10-12 times	10-12 times	10-12 times	5-6 times	5-6 times	5-6 times
Hold the pelvis in the final range for a few seconds with extended knees	The exercise is performed at a slow speed with an extended knee	Hold in the end positions for 1-2 seconds and relax	The technique is performed without forced pressure	The technique is performed to the possible range of movement in the joint	Pulling the lower leg along its longitudinal axis

13	12	11	10	9
Standing	Standing	Standing	Standing	Lying on the back
Passing and catching a ball	Balance board training	Balance board training	Knee stabilization training on a balance board	Rolling the ball with bent knees
15-20 times	6-8 times	30-60 seconds	15-20 times	12-14 times
When feeding and hunting, the patient stands in one place without moving his limbs	The diseased leg is on the board slightly bent at the knee	Training balance on the affected leg with an outstretched knee	The knees are extended the body is tilted back and forth	The exercise is performed at a slow or moderate speed

18	17	16	15	14
Standing	Standing	Standing	Standing	Standing
Walking with obstacles	Walking back	Lateral gait	Walking with a high leg	Passing a ball with your legs
8-10 times	10-12 times	10-20 times	10-12 times	10-15 times
The exercise is performed with medium steps and each step needs to be in the corresponding outline	The condition is that when the patient's leg is brought back, it is extended to the knee	The exercise is performed in short steps	In the swing phase, the patient holds the limb for 1-2 seconds and the supporting leg is extended to the knee	Passing the ball is performed with the patient's foot without rapid movements

20	19
Kinesiotaping	Bicycle ergometer
3 tapes	10-12 min.
We apply the tapes for stimulation of the vastus medialis and vastus lateralis and for stabilization of the tibiofemoral joint	The ergometric training is performed at a moderate speed

3. RESULTS AND ANALYSIS OF THE STUDY

3.1. Results and discussion of the survey to assess the risk factors for soft tissue injuries in the knee joint

Each of the 60 participants was provided with a survey that aimed to identify the most common risk factors for soft tissue damage. To the question "Is the time you spend warming up enough?" 61% of the respondents state that the time they spend warming up is minimal (fig.1.). The analyzed information on this issue from the questionnaire supports the authors' statement that warming up is a major risk factor for soft tissue injury of the knee, probably due not only to the neglect of this element of preparation for play, but also its absence before a sports event.

IS THE TIME YOU SPEND FOR WARMING-UP ENOUGH?

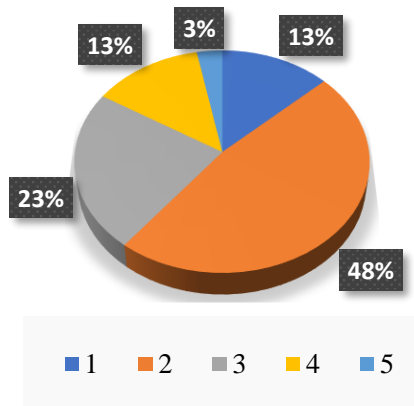


Fig.1. Results from the answer to the question: "Is the time you spend warming up enough?"

As a result of the survey, 17% and 47% of the participants answered that they do not perform stretching or that they spend some time on this component before or after training, shown in Fig.2.

Stretching also occupies a major part of the warm-up and can definitely be considered a risk factor that contributes to the manifestation of soft tissue trauma in the knee complex.

DO YOU DO STRETCHES BEFORE OR AFTER TRAINING?

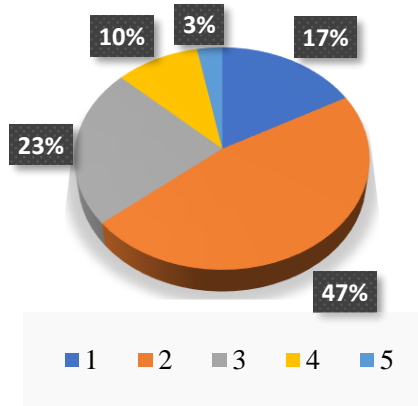


Fig.2. Percentage distribution of patients performing stretching before and after training

The results of the survey on the most common risk factors for soft tissue injuries of the knee joint among the subjects of both groups show that warm-up and in particular stretching as a key element of it are essential for the occurrence of knee injury.

**TO WHAT EXTENT DO YOU PAY ATTENTION TO THE
DEVELOPMENT OF STRENGTH AS QUALITY?**

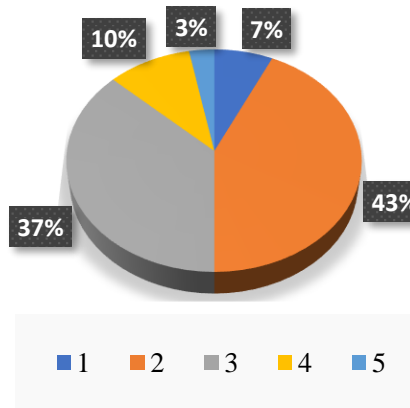


Fig.3. Percentage distribution of patients taking time to develop quality strength

In sports practice, the qualities of strength, endurance and speed are interrelated and that is why we have combined them. Approximately 50% of respondents answered all three questions that they spend little time outside of training to develop the qualities of strength, endurance and speed (Fig. 3, 4 and 5). This leads us to think that neglecting the training of the musculoskeletal and cardio-respiratory systems can be a serious risk factor leading to soft tissue damage.

TO WHAT EXTENT DO YOU PAY ATTENTION TO THE DEVELOPMENT OF DURABILITY AS A QUALITY?

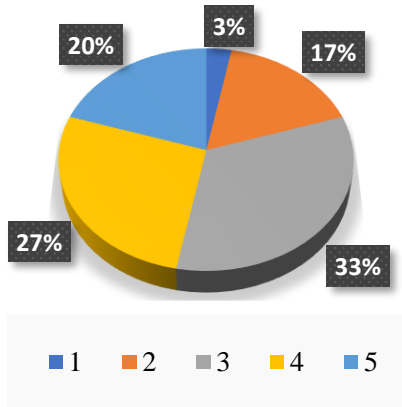


Fig.4. Percentage distribution of patients devoting time to developing endurance quality

TO WHAT EXTENT DO YOU PAY ATTENTION TO THE DEVELOPMENT OF SPEED AS A QUALITY?

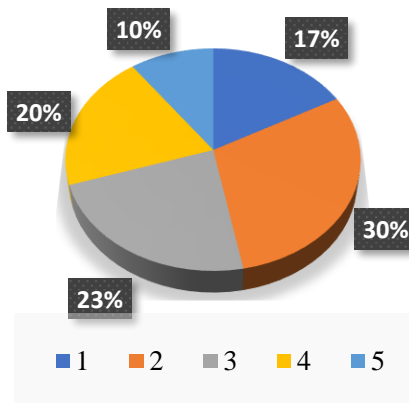


Fig.5. Percentage distribution of patients taking time to develop quality speed

DO YOU FEEL TIRED?

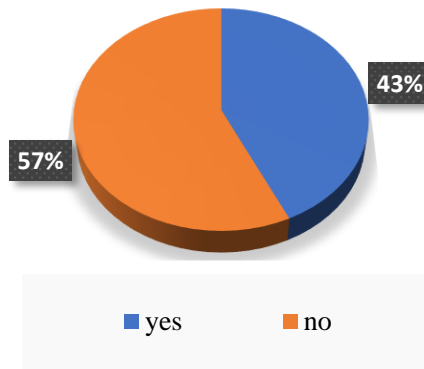


Fig.6. Percentage distribution of patients who feel tired

When asked "do you feel tired", 43% of the participants answered that they feel tired, probably due to the lack of effective rest. The percentage of those who do not spend time on recovery is not insignificant (43%) (Figs. 6 and 7). Most likely, the high percentage of fatigue among the respondents is due to the fact that most of them, in addition to active sports, combine other professional activities that exhaust them physically and mentally and do not have a full recovery. In scientific knowledge and in our research, these two causes show the link between fatigue, recovery and the risk of soft tissue damage.

DO YOU TAKE TIME FOR RECOVERY?

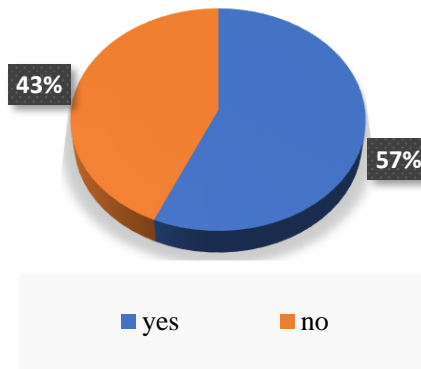


Fig.7. Percentage distribution of patients taking recovery time

We can definitely consider that in the training or competition period the lack of recovery and fatigue are interrelated. The results of the study show that more than half of the subjects feel tired. This leads us to believe that prevention in order to reduce soft tissue injuries in the knee plays an integral part in the overall recovery plan of sports trauma.

3.2. Results and discussion of a survey with a questionnaire for assessing the motor deficit of the knee joint in activities of daily life

Each of the participants was given a globally validated questionnaire before and after the kinesitherapy methodology, which includes two columns. One column provides information about the symptoms leading to functional limitations of the knee complex, and the other column - about the more frequent daily activities that burden the knee (Knee Outcome Survey Activities of Daily Living Scale,

ADLS). There can be more than one answer, but for more accurate information, 1 answer is recommended.

TO WHAT EXTENT DOES PAIN AFFECT YOUR ACTIVITY?

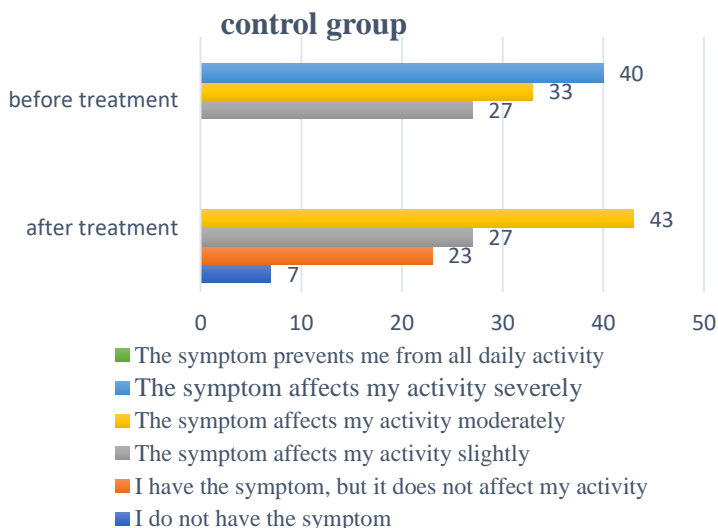


Fig.8. Influence of pain on the activity of CG patients

The analysis of the above results in the control group found a reduction in pain symptoms among participants in whom "classical methodology" was applied. Before starting the kinesitherapy program, 60% of respondents reported that knee pain affected "moderately" (33%) to "slightly" (27%) their activity. After the end of the program, 23% of the participants said that they had a symptom, but it did not affect their activity, and 7% that they had no symptom (Fig. 8).

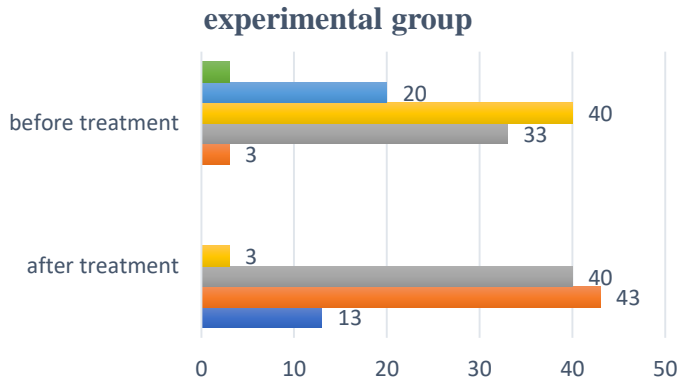


Fig.9. Influence of pain on the activity of EG patients

The questionnaire study before and after the applied program "extended methodology" in the subjects of the experimental group shows a significant impact on pain. Before the program, 40% of participants answered that the symptom affected their activity moderately and 33% that the symptom had a slight effect on their activity. After the end of the program, 53% of the respondents had the predominant answers "the symptom has a slight effect on my activity" (40%) and (13%) "I do not have the symptom" (Fig. 9). These results give us reason to believe that our methodology has a positive effect on the physical activity of the participants by reducing pain symptoms.

TO WHAT DEGREE OF STIFFNESS DOES IT AFFECT YOUR ACTIVITY?

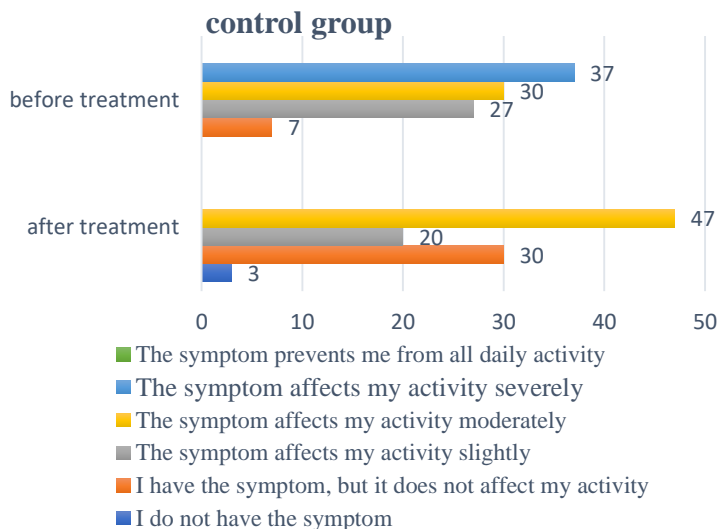


Fig.10. Influence of stiffness on the activity of CG patients

The survey showed that before starting the program, 30% of the control group indicated that knee stiffness affected their activity moderately, and the remaining 34% said that the symptom was slightly (27%) or that they had a symptom, but it does not affect their activity (7%). After the applied classical methodology, 53% of the participants answered that stiffness has a slight effect on their activity (20%), (30%) have a symptom, but it does not affect their activity and (3%) have no symptom (Fig. 10).

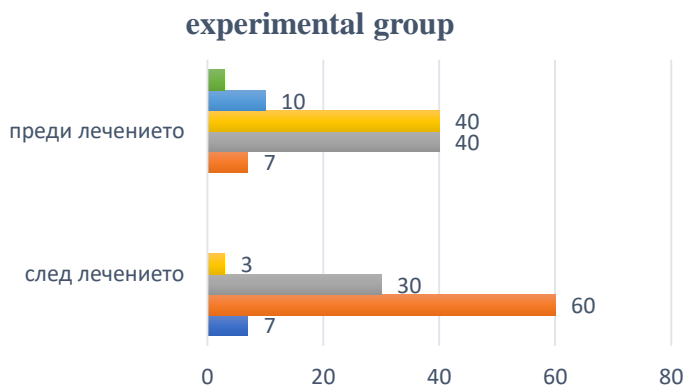


Fig.11. Influence of stiffness on the activity of EG patients

Before starting the kinesitherapy program "extended methodology" 80% of respondents from EG answered that stiffness affects from moderate (40%) to slight (40%) of their activity. After completing the program, mostly EG participants reported having a symptom, but it did not affect their activity (60%) (Fig. 11). After the end of the program we notice a significant reduction in stiffness, which in turn affects the activity in the knee complex.

TO WHAT DEGREE OF INSTABILITY AFFECTS YOUR ACTIVITY?

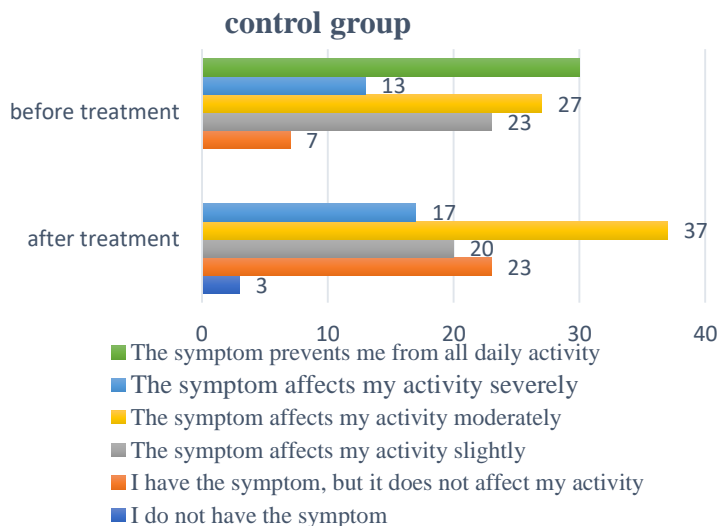


Fig.12. Influence of instability on the activity of CG patients

Before applying the "classical methodology" to the question "To what extent does instability as a symptom affect your level of activity?" 30% of respondents answered that instability does not allow daily activities. After the program, there are no people to indicate that the symptom does not allow daily activities. The percentage of participants from CG answered after the program that the symptom is slight or they have a symptom, but it does not affect their activity is 43% (Fig. 12).

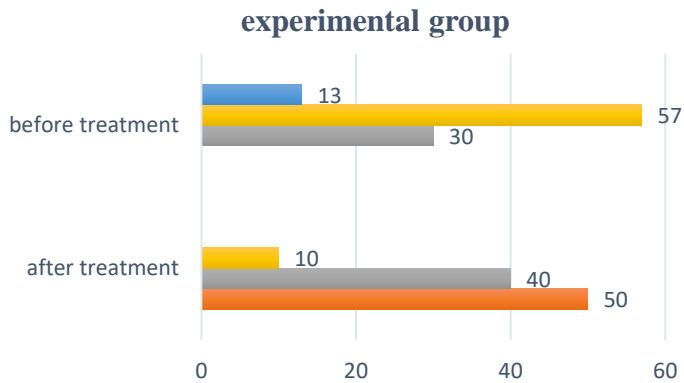


Fig.13. Influence of instability on the activity of EG patients

As a result of the survey conducted before and after the application of the "extended methodology", a significant change in the stability of the knee is observed. Before the program, 87% indicated that the symptom affected moderately (57%) or slightly (30%) their activity, and after the program, half of the participants (50%) said they had a symptom, but it did not affect their activity. At the end of the program, more than 35% of the subjects in the EG had greater stability in the affected knee compared to the time before the start of the kinesitherapy program (Fig. 13).

TO WHAT DEGREE OF WEAKNESS AS A SYMPTOM AFFECTS YOUR ACTIVITY?

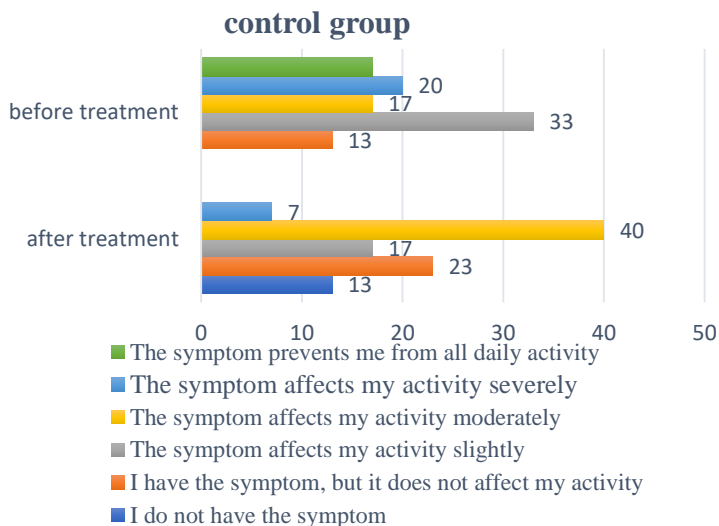


Fig.14. Influence of weakness on the activity of CG patients

Prior to the program, 37% of respondents reported that knee weakness did not allow for daily activities or severely affected their activity. After the application of the "classical methodology" in approximately half of the participants (40%), the symptom has little effect on their activity or they have a symptom, but it does not affect their activity (Fig. 14).

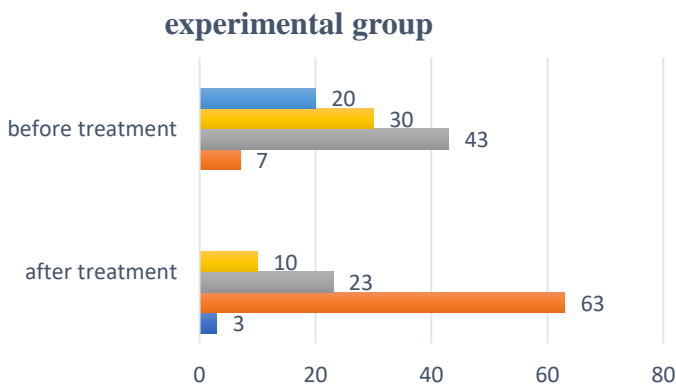


Fig.15. Influence of weakness on the activity of EG patients

Prior to the application of the "extended methodology", 50% of respondents reported that weakness severely (20%) and moderately (30%) affected their activity. After the end of the program, the percentage of participants who indicated the answer "I have a symptom, but it does not affect my activity" increases (63%) (Fig. 15).

In order to clarify and compare the effectiveness of the applied methodologies with regard to the limitations of daily activities, we have identified a group, tentatively called "patients with significant complaints". It included the persons who report that the respective symptom does not allow the performance of daily activities, severely or moderately affects their activity (Table 1).

Table.1. Efficacy of kinesitherapy to reduce symptoms and associated limitations in the activity of patients with significant complaints*. Comparative analysis before and after treatment and between study groups.

Weakness	Instability	Stiffness	Pain	Group / Symptom
53.4	70.0	66.7	73.3	CG
46.7	56.7	46.7	43.3	
6.7	13.3	20.0	30.0	
0.6	0.3	0.12	0.02 ^a	
50.0	70.0	53.3	63.3	EG
10.0	10.0	3.3	3.3	
40.0	60.0	50.0	60.0	
0.0008 ^a	<.0001 ^a	<.0001 ^a	<.0001 ^a	
33.3	45.7	30.0	30.0	Difference EG/CG
0.003 ^a	0.0002 ^a	0.02 ^a	0.02 ^a	P

The values were determined on the basis of the knee joint deficit assessment questionnaire and are presented in %.*

Patients who reported that the symptom did not allow daily activities, severely or moderately affected their activity, were categorized as "significant complaints".

^a - $p > 0.05$

In both study groups there was a statistically significant decrease in cases. Before treatment, patients with significant complaints in the control group were 73.3%, and after treatment decreased to 43.3%, with an average difference of 30%. In the experimental group the decrease was 60% and it was statistically significantly higher than in the control group.

In terms of stiffness, a decrease in cases was again observed in both groups. Before the kinesitherapy program, the patients with significant complaints in the control group were 66.7%, and after the program the percentage was reduced to 46.7%, with an average difference of 20%. In the experimental group the decrease was 50%, which shows that it is statistically higher than in the control group.

In the analysis of instability in CG and EG, a significant decrease in cases was again registered. Before the 10-day course of kinesitherapy, patients with significant, high or moderate instability in the control group were 70%, and after the course of treatment 56.7%, with a mean difference of 13.3%. In the experimental

group, the average difference before and after the kinesitherapy course was 60%.

Similarly, both groups were significantly affected by weakness. Before treatment, patients with significant complaints in the control group were 53.4%, and after treatment 46.7%, with a mean difference of 6.7%. In the experimental group the decrease was 40%, which is definitely statistically higher than in the control group.

3.3. Results and discussion of the study of pain dynamics with a visual analog scale

Each of the patients in the control and experimental group before and after the start of the kinesitherapy program was given a visual analog scale for the assessment of pain symptoms. On the table 2 presents the results of the dynamics of pain in the control and experimental group before and after the completion of our applied kinesitherapy program.

Table 2. Changes in the dynamics of pain in the control and experimental groups

Control group (N=30)	Experimental group (N=30)
---------------------------------------	--

5,83	Before treatment
3,50	After treatment
2,33	Average difference
1,975	95% CI Lower
2,691	95% CI Upper
0,000	P (2-tailed)
5,87	Before treatment
2,67	After treatment
3,20	Average difference
2,779	95% CI Lower
3,621	95% CI Upper
0,000	P (2-tailed)

From the presented data it can be seen that after the application of the kinesitherapy program in the control group the assessment from the visual analog scale decreases by 2.33 points, and in the experimental one by 3.20. The difference in the value of the visually analog scale between the control and experimental group is approximately 1 unit, which definitely shows that the author's methodology applied by us is more effective and leads to better results. Definitely the reduction of pain leads to greater freedom in the joint, greater conviction on the part of patients that the healing process is going in the right direction, and this further stimulates participants to actively participate in the kinesitherapy program.

In a study conducted among 63 subjects in the 5th and 6th postoperative weeks with soft tissue injuries of the knee joint, divided into control and experimental groups (Gramatikova M, 2017) there was a positive trend in pain

intensity. Gramatikova found that the assessment by the VAS improved by -4,187 points in her proposed 10-day kinesitherapy methodology applied to the experimental group. This result is greater than ours in the participants in the experimental group by approximately 1 unit. Most likely, this difference in value is due to the earlier period in which we conducted the study. These close values are an indicator that our proposed kinesitherapy methodology in the 4th and 5th postoperative week is effective and leads to a significant pain suppressant effect.

3.4. Results and discussion of functional studies

Each of the patients in the control and experimental group before and after the start of the kinesitherapy program was subjected to functional tests of angiometry, centimeter and manual muscle testing. On the table 3 presents the results of the angleometry in the knee joint of the participants from the control and experimental group before and after the completion of the applied kinesitherapy program.

Table 3. Results of knee flexion in control and experimental groups

Control group (N=30)	Experimental group (N=30)
---------------------------------------	--

88,83	Before treatment
101,13	After treatment
-12,30	Average difference
-13,765	95% CI Lower
-10,835	95% CI Upper
0,000	P (2-tailed)
91,97	Before treatment
106,77	After treatment
-14,800	Average difference
-15,623	95% CI Lower
-13,977	95% CI Upper
0,000	P (2-tailed)

From the presented data it is clear that the improvement in the range of knee flexion in the participants from the control group was 12.3°, and in the experimental group it increased by 14.8° (Sig = 0.000 < α = 0.05). We can conclude that the author's kinesitherapy methodology applied by us shows better results after the end of the program with 2.5° in the range of knee flexion in the patients from the experimental group compared to the control group. The difference achieved in this way is small, but significant given the short duration of the program. However, we have reason to believe that the author's methodology we apply gives better results.

On the table. 4 we present the mean value, standard deviation and level of significance in the measurements of the extension in the knee joint of the participants in the experimental group.

Table 4. Mean value, standard deviation and significance level in the measurements in the volume of extension in the experimental group

Goniometry – extension	Paired Differences						
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df
				Lower	Upper		
3,400							
3,201							
,584							
2,205							
4,595							
5,817							
29							
,000							

From the above data it is understood that the extension increases by 3.4° after the application of the 10-

day author's kinesitherapy methodology. Regarding the extension in the knee, we definitely observe better results compared to the patients from the control group, which again confirms the effectiveness of the experimental program. Extension of the knee joint gives greater stability in the limb and greater freedom in performing daily activities.

Table 5. Mean value, standard deviation and level of significance in the measurements in the volume of extension in the control group

	Paired Differences						
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df
				Lower	Upper		
							Sig. (2-tailed)

Goniometry - extension	2,767	2,445	,446	1,854	3,680	6,198	29	,000
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In the control group, there was an improvement in the range of knee extension by 2.7° (Table 5). Our results reported from the angiometry after the completion of the 10-day standard methodology show a close value compared to the experimental group, which we attribute to the fact that athletes are still in the early phase of the recovery process and still report a difference between respondents from the two groups with 0.7°.

Table 6. Results of centimeter at the level of the joint gap in the control and experimental group

Control group (N=30)	Experimental group (N=30)

44,63	Before treatment
43,42	After treatment
1,21	Average difference
1,0164	95% CI Lower
1,4169	95% CI Upper
0,000	P (2-tailed)
43,03	Before treatment
41,58	After treatment
1,45	Average difference
1,3366	95% CI Lower
1,5634	95% CI Upper
0,000	P (2-tailed)

Swelling in the knee joint is one of the main symptoms, which disrupts normal arthrokinematics and limits the performance of daily activities. In addition, as a result of immobilization after surgery m. Quadriceps femoris (medial and lateral head) tend to react with malnutrition. In this regard, to assess the quality of recovery of the knee and thigh, we performed centimeters on three levels: at the level of the joint gap, 8 cm and 15 cm from the top of the patella.

On the table. 6 shows that after the performed experimental procedure almost 1 and a half difference in swelling at the level of the joint gap is achieved. At the beginning and at the end of the course of treatment we performed a centimeter of the thigh 8 cm and 15 cm from the top of the patella. Table. 7 and 8 show the results of centimeter of the thigh in the participants from the control

and experimental group before and after the completion of the applied kinesitherapy program.

Table 7. Results of centimeter - 8 cm from the top of the patella in the control and experimental group

Control group (N=30)						Experimental group (N=30)					
Before treatment	After treatment	Average difference	95% CI Lower	95% CI Upper	P (2-tailed)	Before treatment	After treatment	Average difference	95% CI Lower	95% CI Upper	P (2-tailed)
44,767	45,433	-0,6667	-0,8587	-0,4747	0,000	43,900	44,967	-1,0667	-1,1312	-1,0021	0,000

From the data presented in table. 7 and 8 it is clear that in the experimental group the circumferences of the thigh increase by 1 cm, which for this period of kinesitherapy can be considered as an exceptional achievement. The obtained results give us the right to believe that kinesitherapy plays a major role in the recovery process in patients with this type of pathology, as the reduction of edema and increase in hip circumference, respectively reduction of symptoms help to include more kinesitherapeutic means in the early recovery period.

Table 8. Results of centimeter - 15 cm from the top of the patella in the control and experimental group

Control group (N=30)						Experimental group (N=30)					
Before treatment	After treatment	Average difference	95% CI Lower	95% CI Upper	P (2-tailed)	Before treatment	After treatment	Average difference	95% CI Lower	95% CI Upper	P (2-tailed)
49,333	50,033	-0,7000	-0,8937	-0,5063	0,000	48,767	49,933	-1,1667	-1,2901	-1,0433	0,000

Gramatikova M. in her research puts kinesiotaping in the foreground, defining it as an effective means of reducing swelling in athletes with soft tissue injuries of the knee joint in the moderately protective period. To improve lymph flow, we apply manual lymphatic drainage and in the experimental group we report almost 1 cm and a half difference after the 10-day program, which offers manual lymphatic drainage as another option for earlier treatment of knee swelling in soft tissue injuries. On the table. 9 presents the results of manual muscle testing in the control and experimental group:

Table 9. Results of manual muscle testing of knee extension in control and experimental groups

Control group (N=30)						Experimental group (N=30)					
Before treatment	After treatment	Average difference	95% CI Lower	95% CI Upper	P (2-tailed)	Before treatment	After treatment	Average difference	95% CI Lower	95% CI Upper	P (2-tailed)
2,43	3,57	-1,133	-1,295	-0,971	0,000	2,63	3,93	-1,300	-1,474	-1,126	0,000

From the data presented in this way, it is understood that the score from the manual muscle testing of the knee extension in the participants from the experimental group improved by 1.3 (Sig = 0.000 < α = 0.05).

On the table. 10 shows that the values from the performed manual muscle testing of the knee flexion in the control and experimental group are close. Probably the reason for this is that the patients are in the early phase of the recovery process and that the tools we use in this period are focused on improving the arthrokinematics and stability of the knee complex.

Table 10. Results of manual muscle testing of knee flexion in control and experimental groups

Контролна група (N=30)						Експериментална група (N=30)					
Before treatment	After treatment	Average difference	95% CI Lower	95% CI Upper	P (2-tailed)	Before treatment	After treatment	Average difference	95% CI Lower	95% CI Upper	P (2-tailed)
2,50	3,67	-1,167	-1,365	-0,969	0,000	2,67	3,80	-1,133	-1,295	-0,971	0,000

In the statistical processing of data and from our clinical experience in working with patients with pathology in the knee complex, it becomes clear that the application of an individual approach and timely application of kinesitherapy lead to earlier functional recovery. Definitely the results obtained from the methodology applied by us are better compared to the classic kinesitherapy programs after soft tissue injuries of the knee. In addition to the better results in anthropometric measurements, a significant improvement of the methodology applied by us is also observed in the

reduction of the pain syndrome, swelling, stability, stiffness in the affected limb. We can convincingly conclude that this methodology successfully finds a place in the recovery period of patients with soft tissue injuries of the knee.

4. CONCLUSIONS

- pain symptoms before and after the applied program in the respondents from EG showed a significant response (13% have no pain after the author's kinesitherapy method on the background of 7% with no pain in the control group);
- the subjects from the experimental group (50%) indicate that they have knee instability, which does not affect the activity (against the background of the control group - 23%);
- the reduction of muscle weakness leads to an increase in the strength of the flexors in the same area;
- after the application of the kinesitherapy program in EG the assessment by the VAS decreases by 3.2 points;
- the improvement in the range of knee flexion increases by 14.8°;
- the extension increased by 3.4° after the application of the 10-day author's kinesitherapy methodology.
- significantly affects the pain symptoms, stiffness and stability, which improves gait;

- leads to better indicators in the range of movement and thus patients are more successful in performing daily activities.

5. IMPLICATIONS

- A study on the role and place of kinesitherapy in the secondary prevention of soft tissue injuries in athletes has been made.
- A wide database of available kinesitherapeutic literature, electronic publications and scientific forums related to the significance and relevance of the problem is analyzed.
- A kinesitherapeutic methodology and prevention program for athletes with soft tissue injuries of the knee in outpatient and home settings have been developed and applied.
- The application of the prevention model proposed by us in sports clubs contributes to the reduction of soft tissue injuries of the knee complex in athletes.

6. RECOMMENDATIONS

- A necessary condition for the development of an individual prevention model for athletes who have experienced soft tissue damage in the knee area is a thorough knowledge of the mechanisms and risk factors in sports practice.
- To achieve better results in athletes with soft tissue disabilities, we recommend multidisciplinary

collaboration with other specialists such as: orthopedist, rehabilitator, sports psychologist, nutritionist.

- The kinesitherapeutic methodology proposed by us could be used as a prevention model for reducing the frequency of soft tissue injuries in the knee joint.
- In the prevention and prevention of the athlete we pay special attention to the partnership between the physiotherapist and the coach according to the needs of the player.
- In order for the prevention methodology to be as effective as possible, we recommend that it be part of the general training of the athlete.

7. Publications related to the dissertation work

- **Shivachev Y**, Grozdeva D, Bogomilova St. Meridian massage and post-isometric relaxation in treatment of tension headache. *Varna medical forum*. 2017; 6(2): 196-198. ISSN 1314-8338 (Print); ISSN 2367-5519 (Online).
- **Shivachev Y**, Lazarova Sl, Panova Cv. Patient-centered approach in cerebral palsy – presentation of a clinical case. *Varna medical forum*. 2017; 6(1): 67-68. ISSN 1314-8338 (Print); ISSN 2367-5519 (Online).
- Bogomilova St, **Shivachev Y**, Nenova G. Early kinesitherapy for ACL plastic with Pull-up system. *20th Student scientific conference “Kinesitherapy”*. 2019: 47-51. ISBN 978-954-00-0206-4.