

## **CHANGES IN THE SUPPORT STABILITY INDICATORS AFTER ARTHROSCOPIC KNEE INTERVENTION**

*(Preliminary communication)*

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### **Abstract**

*The study was conducted on the patients - men (21) and women (10) aged 21 to 41 as shown in the Table below, from September to December, 2013, in Sofia, in the Military Medical Academy, Government Hospital "Lozenets" and MHAT "Saint Sophia". This purpose a test stepping on two identical mini platforms (type rungs) at the same time, was used. The test is based on the measurement of the body weight percentage, taken on the healthy and damaged leg and the changes in the ratio during the healing period. A study was conducted applying an author's original methodology on changes in support of the damaged leg after reconstruction of the anterior cruciate ligament. Platforms are used to measure the pressure (barical influence) of both legs and to establish the differences. The study is twice-timed - before and after the ten-day course of recovery. Statistical methods were applied. Regularities in the recovery of patients were established. The conclusions of the study are outlined. Recommendations for the kinesiotherapeutic practice are formulated. Methodology for an objective examination of the changes in the support of the injured leg is proposed. Its indicator, on the one hand, is indicative of the effectiveness of the restoration methodology, and on the other hand, provides researchers with the precise quantitative measurement of the healing process intensity.*

**Keywords:** *soft tissue damages, anterior cruciate ligament, muscle hypotrophy, muscle hypotrophy, muscle hypotrophy, body weight, physical exercises, goniometry, static muscle endurance, coefficient of reliability*

### **INTRODUCTION**

It is well known that the arthroscopic knee interventions for restoring soft tissue damages are followed by a long term recovery of the arthrokinematics and dynamic joint's stability.

Kinesiotherapy aims to restore manifested dysfunctions: decreased range of motion, muscle imbalances, decreased muscle strength and endurance, pain, edema, muscle hypotrophy, claudication, unstable gait, reduced proprioception and muscle control, etc.

To this purpose, kinesiotherapy needs to have adequate functional tests for the evaluation of the dysfunctions and manifested pathologies.

The functional evaluation of patients is made individually and based on it a program of kinesiotherapy, also individually based and consistent with the functional abilities and dysfunctions of the patient, is prepared.

### **Aim of the study**

Establishing changes in support of the knee joint soft tissue damages after arthroscopic intervention in the process of active recovery.

### **Tasks of the study**

1. Practice approbating of a new test for assessing the support of the damaged lower limb.
2. Study of the test reliability.
3. Establishment of the healing process intensity through the application of that test.

### **METHODS**

- Analysis of literary sources (method of deduction)
- Testing
- Expert assessment

### **Contingent of study**

The study was conducted on the patients - men (21) and women (10) aged 21 to 41 as shown in the Table below.

### **Organization of the study**

The study was conducted from September to December, 2013, in Sofia, in the Military Medical Academy, Government Hospital "Lozenets" and MHAT "Saint Sophia".

Table 1. Contingent of the study

Age	Men		Women		Total	
	Number	%	Number	%	Number	%
To 21	6	28	4	40	10	32
22 - 30	10	48	2	20	12	39
31 - 40	5	24	3	30	8	26
Over 41	0	0	1	10	1	3
Total	21	100	10	100	31	100

This purpose a test - stepping on two identical mini platforms (type rungs) at the same time, was used. The test is based on the measurement of the body weight percentage, taken on the healthy and damaged leg and the changes in the ratio during the healing period.

The kinesiotherapy was administered for 10 consecutive working days during the moderate-protective period (second postoperative month) after arthroscopic reconstruction of the anterior cruciate ligament.

After 10 days-targeted impacts on the pointed knee soft tissue damages there followed an analogous to the output testing of the two legs support. In a recorded mean weight of the patients of 66,6 kg, in a regular, stable support, each of the legs should take on 33,3 kg.

As stated above, during the ten-day targeted impact, the aim of the kinesiotherapy was a recovery of the arthrokinematics and dynamic joint's stability, recovery of the myo-articular dysfunctions, developing as a result of the surgery and the hypokinesia. Full recovery of the patients' functional abilities and the introduction into their normal activities - the complex motor activities of daily life, hobbies, work, and in athletes - to the level of high sports mastery.

The applied kinesiotherapy methodology includes means, methods and forms of organization of the targeted impacts with structure and content of the procedures, dosage of impact and methodical instructions for its implementation.

Basic means are diverse dosed exercises (isometric, isotonic, eccentric) passive, assisted and active, in opened and closed kinematic chain.

Supplementary means are: electrostimulation, interference current, cryotherapy, massage, lymphatic drainage, positional therapy, post-isometric relaxation, proprioceptive neuro-muscular facilitation, stretching, mobilization of peripheral joints, mechano-therapy, proprioceptive training, techniques to improve strength and endurance, aquatherapy, etc.

The most often used methods of physical strain to improve the flexibility, strength, endurance and other motor skills are the repeated and the regular method. During the repeated method, the effect is achieved through a repeated performance of the motor actions in series, with a break between them. During the regular method, the effect is achieved through a repeated performance repeated without a break, prolonged with low intensity.

The dosage of the effects is made by regulating the repeats, a change in the amplitude of the movement, by external resistances (weights, trainers, elastic straps, etc.), by changing the start position, by the duration of the impact.

Organizational forms of kinesiotherapy are implemented through:

- procedures, carried out by a kinesiotherapist
- aquatherapy, carried out by a kinesiotherapist
- independent activities, at home, as prescribed

The applied kinesiotherapy in the moderate-protective period included:

1. Interferential current - 15 minutes
2. Electrostimulation of m.quadriceps femoris -15 minutes for reducing pain and edema, stimulating metabolic processes, prevention of muscular hypotrophy
3. Cryotherapy - pain suppressor effect
4. Massage (lymphatic drainage) -for edema resorption (in a position of joint relaxation)
5. Isometric exercises for femoral and ischiocrural musculature in different starting positions - prevention of muscular hypotrophy and reflective muscle inhibition; of the operated limb
6. Exercises, supporting the recovery of flexion and extension in the knee joint. Prevention against myo-articular contractures, without causing pain and discomfort
7. Mobilization of patella
8. Stretching exercises and muscle-inhibitory techniques for hypertonic muscles (m.rectus femoris and iliotibial tendon) - improves the volume of movement. Do not cross the border of the soft tissue barrier
9. Post-isometric relaxation for m. rectus femoris and other spastic and shortened muscles-recovers muscle balance-relaxation and extension of hypertonic and shortened muscles. In the presence of edema, post-isometric relaxation is not applicable
10. Exercises for balance and equilibrium, the operated leg is 100% loaded with body weight - recovery of the neuro-muscular control, proprioception, dynamic joint's stability, postural balance
11. Training in proper walking with full loading on the operated leg - normalization of the motor stereotype when walking. Postural disorders are corrected
12. Walking on treadmill-10 minutes (forward, backward, sideways)

13. Exercise bike - 10-15 minutes - Improves muscle strength, endurance, and by lowering the seat gradually, improves the flexion, too

14. Exercises in water. Swimming style - Crawl back. Riding an exercise bike underwater. Aquatherapy improves neuro-muscular control, the dynamic joint's stability, muscle balance. Rate - slow to moderate. Duration 45-60 minutes. It takes place after the procedure in kinesiotherapy.

Kinesiotherapy methods include: functional studies (centimetria, goniometry, visual analog scale for pain, manually-muscle testing, measurement of the support distribution, static muscle endurance, a test on the static capsule-ligament stability, a test for dynamic power of lower limbs, explosive power, functional rating scale, length of stride with injured and with healthy leg, number of strides for passing 10 meters), which are made on the first day and again after 10 days. Electrostimulation, cryotherapy, massage, analytical exercises to restore the arthrokinematics and the dynamic joint's stability, passive and active exercises in opened and closed kinematic

chain, with and without resistance, mechanotherapy, exercise of balance and coordination.

## RESULTS AND DISCUSSION

Before the study, an approbation of the test was conducted, followed by the verification of its reliability.  $r_{tt} = 0,85$  was found, which justifies its use. A verification of the studied cases distributions was conducted, too.

As a result of the statistical processing of the empirical material, following results were obtained (Table 3).

It was found that the average weight of the studied patients before initiation of the recovery was 66,6 kg. During procedure patients were advised to press feet firmly on the two platforms, stand still, look forward and then the pressure on the support of the healthy and damaged leg (in kg) was recorded.

The results show that during the first day of the study, patients, as expected, trust in a higher degree their healthy leg, which takes average 67,22% of their weight, and only 32,77% of the damaged leg.

In absolute values -the results match average to

Table 2. Individual changes of indicators

Patient №	The support of the healthy leg (in kg)	The support of the damaged leg (in kg)	The support of the healthy leg (in kg)	The support of the damaged leg (in kg)
1.	42,0	23,0	35,5	29,5
2.	43,0	22,5	32,5	32,5
3.	42,5	24,5	36,5	30,5
4.	33,5	16,5	28,0	22,5
5.	66,0	13,0	54,5	24,5
6.	40,0	25,0	35,0	30,0
7.	59,3	18,2	45,3	32,2
8.	27,0	25,0	26,0	26,0
9.	36,8	13,2	28,7	21,3
10.	44,0	26,0	37,9	32,1
11.	32,9	32,9	32,9	32,9
12.	43,1	36,0	42,1	37,0
13.	42,5	17,5	31,7	30,2
14.	43,0	32,0	38,2	37,1
15.	42,0	36,0	39,3	37,7
16.	41,3	33,5	38,1	37,7
17.	61,3	12,7	48,7	25,3
18.	62,6	12,4	48,2	26,8
19.	63,0	22,0	45,8	39,2
20.	50,7	15,3	37,8	28,2
21.	60,8	10,2	52,3	18,7
22.	51,0	17,0	42,0	26,0
23.	71,0	22,0	52,0	41,0
24.	57,0	16,0	42,0	31,0
25.	43,0	37,0	40,0	40,0
26.	42,0	35,0	40,0	37,0
27.	56,0	50,0	55,0	51,0
28.	45,4	39,3	43,3	41,3
29.	62,5	17,5	48,0	32,0
30.	50,0	39,6	46,0	45,0
31.	53,5	32,2	42,6	41,2

Table 3. Changes in the support of the damaged leg in the process of its recovery in the studied group

Indicators	Before starting the procedures		After 10-day procedures	
	The support of the healthy leg (in kg)	The support of the damaged leg(in kg)	The support of the healthy leg (in kg)	The support of the damaged leg (in kg)
$X$	44,77	21,83	35,90	30,7
$S$	3,88	3,11	2,59	3,1
$V\%$	8,67	14,24	7,21	10,1
$m_x$	1,39	1,73	0,93	1,1
$D$	43,38-46,16	20,1-23,56	34,97-36,83	29,6-31,8

44,77 kg of the patient's weight, borne by their healthy leg, and 21,83 kg of the damaged one, or the difference in relative values is 34,45% or 22,94 kg difference.

The values are not high and range from 2,59 to 3,88. The  $V\%$  values are relatively low which indicates that the sample of patients is relatively compact to the studied indicator.

The small values of  $m_x$  (from 0,93 to 1,73) presuppose a small confidence interval ( $D$ ) of  $X_{av}$  too

Preparation of individual kinesiio-therapeutic complex is obligatory, after the functional assessment of the patient's condition, and the pathokinesiio-logical and pathofunctional features of the moderate-protective period after the reconstruction of the knee joint anterior cruciate ligament.

The diagnosis of the functional parameters is permanent (1st and 10th day), but if necessary, they can be measured meanwhile, too. It accompanies the whole kinesiio-therapeutic process, tracing the intensity of recovery.

The results show that the pressure of the healthy leg in absolute values is on average 35,9kg, and of the damaged one - 30,7 kg. As evident from the results, the recovery is intense and substantial. The improvement of the damaged leg is with 8,87 kg, or with 40,6%, a result achieved as a 10-day directed kinesiiotherapy impact.

## CONCLUSION

1. The study applied a new methodology of testing the changes in the support of the lower limbs. It proved to be reliable and applicable for identification of the healing process intensity in patients with soft tissue and other knee damage.

2. The shown research methodology is appropriate for establishing the effectiveness of the applied kinesiio-therapeutic model for targeted impact on the lower limbs.

3. The conducted study shows that a ten-day course of kinesiio-therapy with the pointed out model of kinesiio-therapy achieves a significant recovery of the patients with these knee damages.

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