

Original Article

Postoperative Rehabilitation Using the Means of Fitness in the Ligamentoplasty of ACL Rupture in the Knee

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Abstract

Purpose: Presentation of the content and results of postoperative rehabilitation in the ligamentoplasty of anterior cruciate ligament (ACL) rupture in the knee with the help of the fitness means.

Material. A study of case was organized for this purpose, with only one subject diagnosed with instability of the left knee (old ACL rupture) local hematoma, clinically and radiologically confirmed. Surgery is performed using arthroscopy - ligamentoplasty ACL with OTO autograft. The subject had a favorable post-surgery evolution and was discharged with the following recommendations: dressings every three days, removal of the sutures 14 days after surgery, rehabilitation gym continued according to the program; walking with progressive support on the operated foot, treatment in conformity with Rp and check up in the clinic after 6 weeks.

Results. The analysis of the means of fitness used during the rehabilitation sessions revealed that those means of fitness (exercises and apparatus) that would not impede or aggravate the rehabilitation were selected for the first sessions. In some cases, compensatory workouts were made with one limb (leg) on some apparatus, paying attention to the load optimization and effort dosing for each exercise.

Conclusions. The observance of the general principles and the efficient use of the kinesiological techniques for postoperative rehabilitation at knee joint level with the help of the fitness means contributed to toning and developing the muscle strength and resistance and to the reduction of joint ligament stability at the knee.

Key Words: kinesiotherapy, knee, rehabilitation, means of fitness, ligamentoplasty

Introduction

The favorable effects that sports and, in general, human activity have on the health, the individual and the community are already known and also scientifically proven since numerous studies describe the mechanisms by which physical exercises influence the functions and systems of the human body. The physical activity practiced regularly determines the maintenance or improvement of the structure of various tissues or organs (muscles, tendons, heart etc.), ameliorate the functions and counteract the deteriorations that occur because of inactivity (sedentary lifestyle) and aging. That is why in the USA the term “fitness” defines the physical condition while the term “health” defines the health status; these two terms are quasi-similar. Kinesiology is part of physical medicine and represents the therapy by movement for the purpose of restoring or consolidating some functions of the human body by regulating the imbalance present in the body that can generate certain disorders. This practice is an individualized therapeutic form that uses several methods (water, massage, heat or electricity are also used besides the movement) and can be a part of the prophylactic (preventive), curative or rehabilitation therapeutic programs (Sbenghe, 1997, 1999; Man & Trif, 2009, Kinetomed).

Medical kinesiology is an interdisciplinary biological science that deals exclusively with the study of the human body movement, the anatomic-functional elements that contribute to movement achievement and the modalities of correction and/or compensation of the reversible, partially reversible or irreversible disorders (Cordun, 1999). Kinesiotherapy uses the means of the medical kinesiology for performing the somatic-functional, motor and mental rehabilitation and/or the re-education of the secondary, compensation functions, in the case of the partially reversible or irreversible disorders (Marcu, 1998; Cordun, 1999).

The knee is the part of the lower limb where the leg joins the thigh. Knee joint must be movable and supple in order to allow the flexion and extension of the lower limb. It must also be stable, taking into account the fact that it supports the entire weight of the body (Dragulin, 2019). The knee joint is the largest joint of human body; it is the mobile segment of the locomotor system that joins the thigh and the leg. It is a trochlear

(hinge) uniaxial joint, with only one degree of freedom, allowing the flexion and extension movements. Internal or external rotation movements can be made when the knee is slightly bent, but their amplitude is very small (Gavrilescu, 2010).

The anterior cruciate ligament (ACL) plays an important role in the biomechanics of the knee. ACL takes over 85% of the force that translates the tibia anteriorly, preventing its anterior sliding relative to the femur and limiting the hyperextension (Badea, 2010).

In the different sports activities, the ligamentous apparatus that limits the movements of the knee is particularly strained. Forcing the knee in valgus (inwards) or in varus (outwards), whether or not accompanied by twisting the leg on the thigh, results in injuries of different intensities of the lateral ligaments. Thus, the sprain of the internal collateral ligament is classic. Due to its role in the static and dynamic biomechanics of the lower limb, but also due to its low soft tissues coverage, the knee joint is prone to all types of trauma (Cotoman, 2006).

Physical exercises produce stable physiological effects only through a long-term methodical training. Effects of both dynamic and static physical exercises can occur during the rehabilitation of the knee stability (Cordun, 1999; Sabău, 2006).

The rehabilitation is defined by I. Drăgan, (2002) as „the process of directed use of some natural or artificial factors, as early and intensively as possible, for the purpose of the anatomic and functional recovery of an organ or functions disturbed by sports effort, accidentally or in time, for the fast reintegration in the training process” (Drăgan, 2002).

The successful rehabilitation of knee functionality depends equally on the surgical act and the toning program (isometric, isokinetic, isotonic) regarding the performance of the contraction of lower limb muscles – knee in closed kinetic chain and open kinetic chain. The efficacy and success of the functional rehabilitation of the knee after traumatic injuries depends on the rehabilitation protocols and the therapeutic methods used (Burcea, 2019).

The evaluation, diagnosis, treatment and rehabilitation in the failure of the Anterior Cruciate Ligament Rehabilitation (ACLR) is complex. The success of ACLR revision requires a correct diagnosis regarding the cause of the failure, a proper preoperative planning and adequate selection of patients, a well-performed surgical technique and individualized rehabilitation programs for each patient (Andrei, 2019).

According to the statistical information provided by the National Institute of Sports Medicine – Bucharest, the most frequent traumas occur at the level of the lower limbs (57.7%) and the upper limbs (21.25%).

The anterior cruciate ligament (ACL) can be torn by several mechanisms. It can be also injured by the forced passage from flexion to extension, with the knee rotated externally. The posterior-external cruciate ligament tears very rarely, when the blow on the leg catches the knee in flexion. The meniscus and ligament injuries change the stability and mobility of the knee (Nitulescu, 2008; <http://www.ortokinetic.ro/>).

The ligamentoplasty includes several techniques of reconstruction. A torn ligament can not be repaired by a simple suture of the ends because it has in its composition thousands of collagen fibers, which withdraw and become fibrous after the injury. That is why it is totally replaced by a new ligament, created from the own structures of the body (autograft), that mimics the native properties of ACL, taking over its function (Predescu, 2013; Stănescu & Popescu, 2018).

The purpose of the paper is to present the content and results of postoperative rehabilitation in the ligamentoplasty of anterior cruciate ligament (ACL) rupture in the knee with the help of the fitness means.

Hypothesis of the paper. We consider that the observance of the general principles and the efficient use of kinesiology techniques for postoperative rehabilitation at knee joint level with the help fitness means will lead to the toning and development of the muscle strength and resistance.

Material & methods

Participants and procedure

The subject of the study is a former athlete of 33 years old, football player from 7 to 24 years; he is one meter ninety-three tall and he weighs 94 kg.

The patient was admitted to hospital with the diagnosis “instability of left knee” (old ACL rupture), local hematoma, clinically and radiologically confirmed. Surgery is performed in the Orthopedic Department of “Colentina” Clinical Hospital, using Arthroscopy - Ligamentoplasty ACL with OTO autograft. The patient had a favorable post-surgery evolution and was discharged with the following recommendations: dressings every three days, removal of the sutures 14 days after surgery, rehabilitation gym continued according to the program applied with a teacher of Medical Physical Culture; walking with progressive support on the operated foot, treatment in conformity with Rp and check up in the clinic after 6 weeks.

The rehabilitation started with isometric exercises, then on apparatus with progressive load.

After surgery, the leg was immobilized with an orthosis that helped to maintain the extension.

During the first 3 weeks, the subject made the exercises as follows:

- isometry (isometric contractions of quadriceps muscle, passive extensions, flexions, raising the leg at 30 to 40 degrees and keeping it so for 5 sec.),

- foot movement back and forth – as many reps as possible,
- tiptoeing and keeping this position, flexion must reach 120-125 degrees.

After 3 weeks, the crutches and orthosis were no more used and the subject started to make exercises with progressive load and fitness equipment. Bike - 10 min passive pedaling, passive walking on the treadmill, waling on tiptoes and on heels, exercises with flexions and extensions on the fitness apparatus with progressive load and maintaining for 10 seconds at each rep, 4 sets of 15 reps each.

After 6 weeks - infiltrations with blood plasma, repeated 3 months later. Easy run after 3 to 4 months.

After 6 months the knee was rehabilitated and the sports activity was resumed.

Results

Tables 1 and 2 show the content of the fitness means for the rehabilitation of the lower limbs muscle strength - weeks 1 to 4 and 5 to 8 respectively, in terms of weight and number of reps used on different apparatus and muscle groups.

Table 1. Content of the fitness means for rehabilitation of the lower limbs muscle strength, weeks 1 to 4

Statistical indicators	Week 1		Week 2		Week 3		Week 4	
	Kg	No of reps	Kg	No of reps	Kg	No of reps	Kg	No of reps
Mean	22	20	25.19	20	29.36	19.8	30.68	19.8
S.E.M.	0.77	0	1.57	0	1.7	0.12	2.03	0.11
S.D.	3.77	0	9.4	0	10.4	0.77	13.02	0.77
Coef. Var.	0.17	0	0.37	0	0.35	0.04	0.42	0.04
Minimum	16	20	16	20	16	15	5	15
Maximum	25	20	41	20	49	20	57	20

Table 2. Content of the fitness means for rehabilitation of the lower limbs muscle strength, weeks 5 to 8

Statistical indicators	Week 5		Week 6		Week 7		Week 8	
	Kg	No of reps	Kg	No of reps	Kg	No of reps	Kg	No of reps
Mean	31.07	20	35.74	18.9	36.26	19.04	31.77	20
S.E.M.	2.05	0	2.15	0.46	2.19	0.45	1.77	0
S.D.	13.2	0	13.8	3.03	14.05	2.97	9.9	0
Coef. Var.	0.42	0	0.38	0.16	0.38	0.15	0.31	0
Minimum	5	20	10	10	10	10	10	20
Maximum	57	20	65	20	65	20	49	20

Notes (tables 1 & 2): Means and muscles: Incline press 45° - quadriceps + gluteal muscles; Horizontal press – quadriceps + gluteal muscles; Horizontal press – quadriceps + gluteal muscles / right.& left leg; Roman chair - quadriceps muscles; Bench & chair – femoral biceps; „Pendulum” type apparatus - gluteal muscles - right.& left leg.; Apparatus - adductor & abductor muscles of lower limbs

Discussion

Specifying the objectives, both general or basic ones and goals specific to the field of kinesiotherapy is an important starting point in the activity of the future kinesiotherapist (Baciu, 1981; Cotoman, 2006; Moțet, 1997; Teleki et al., 1986; Sbenghe, 1999). In order to achieve the proposed objectives, the kinesiology uses a series of techniques, methods and means. The basic kinesiology techniques are the akinetic & kinetic ones. The following methods and means were used: De Lorme-Watkins method, regarding the progressive resistance exercises meant to increase the muscle force; Jacobson and Schultze methods– for progressive muscle relaxation (Flora, 2002; Cotoman, 2006) and the means of fitness (Sakizlian, 2011).

The analysis of the problems of our study highlighted different concerns of the specialists regarding the anatomy of the knee, the functions of the knee joint, the signs, symptoms and pathologies related to the knee, examination – diagnosis and treatment, recommending various topics of the medical library (Dragulin, 2019); other specialists focus on the period after the anterior cruciate ligament surgery, in terms of surgical and kinesiology treatment (Badea, 2010). The “Kinetomed” team is specialized in the postoperative rehabilitation of the anterior cruciate ligament (ACL) reconstruction; in the last 5 years they performed more than 400 rehabilitations after ligamentoplasties from the second week up to the sixth month, for both performance athletes and persons who do sports for pleasure (Man & Trif, 2009). Also, in the “Lesson of orthopedics”, dr. Andrei, I-B., specialist of orthopedics-traumatology, presents the “Sports pathology of the knee” and the “Protocol of rehabilitation after ligamentoplasty” while, in the “Centroknetic” Clinic, he and his team show the stages of the rehabilitation in the “Rehabilitation after the revision anterior cruciate ligament” . In this sense we mention the approaches regarding the “Rupture of the anterior cruciate ligament (ACL) of the knee” (Nitulescu, 2008) and,

last but not least, the "Reconstruction of Anterior Cruciate Ligament" presented as a Patient Guide (Predescu, 2013).

We did not find studies about the rehabilitation using the means of fitness after ligamentoplasty of ACL rupture in the knee, but we found studies on the methods and techniques of muscular toning of the locomotor system with the help of fitness means (Potop et al., 2009; Timnea, Potop, & Ulăreanu, 2013; Timnea, Potop, & Cheran, 2013; Ulăreanu, Potop, & Grigore, 2019).

The results of our study highlight the content of the fitness means used for the rehabilitation of the lower limbs muscles strength. The review of the anamnesis showed that the subject applied correctly the kinesiology techniques during the traumatic rehabilitation. As for the program of the rehabilitation sessions, during the first two weeks the subject of the study had workouts in the fitness gym almost every day, with day off on Saturday and Sunday. The discussions after each session revealed that the subject complained of back pains in the lumbar area; therefore the weights were decreased and the number of sessions was reduced up to 2 or 3 sessions weekly.

The analysis of the fitness means used in the rehabilitation sessions revealed that specific means of fitness (exercises and apparatus) that would not impede or aggravate the rehabilitation were selected for the first sessions. In some cases, compensatory workouts were made with one limb (leg) on some apparatus, focusing on the load optimization and effort dosing during each exercise.

Conclusions

Following the study, we can find out that the recovery of the muscle mass of the injured leg did not reach the dimensions of the healthy leg, slightly exceeding the proportions of these perimeters after the rehabilitation. This kinesiology approach requires further study in order to achieve the rehabilitation of the total muscle force and mass, even if the ligamentous instability will remain permanent.

The incorrect use of the kinesiology techniques, without taking into consideration the reactions and the pains occurred during the rehabilitation, can lead to the aggravation of the situation.

The observance of the general principles and the efficient use of kinesiology techniques for posttraumatic rehabilitation at knee joint level with the help of fitness means contribute to the toning and development of the muscle strength and resistance and to the diminution of the ligament instability of the knee.

Conflicts of interest - The authors have no conflicts of interest to declare.

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