RECOVERY IN POSTTRAUMATIC INJURIES OF ANTERIOR CRUCIATE LIGAMENT IN PRO LEVEL SPORTS ACTIVITIES

Haidamac Ana

„ Ştefan cel Mare" University, Suceava, e-mail: anahaidamac@ yahoo.com

Abstract
Sports activities in their rush to performance growth generate injuries and unfortunately the knee joint is one of the most exposed. Through early applying of an efficient kinetic treatment it might be achieved a functional and stable knee which could withstand the hardness of the sports activity. The postoperatively kinetic treatment of anterior cruciate ligament reconstructions recovers and strenghtens the normal function of the knee favouring the rapid resume of sports activity.

Key words: stability, mobility, proprioception, recovery, knee joint.

Introduction

Anterior cruciate ligament's (ACL's) posttraumatic injuries with a high frequency in knee sprains which have other associated injuries manifest through signs and simptoms starting with pain, edem, knee joint instability and could go as far as affecting the gait. ACL injuries are moslty determined by the body movement and posture during the sports activities due to inability to absorb the weight of the body in the rebalancing act.
Study's main objectives were the selection of most suitable and efficient means used in kinetoterapy for the treatment of ACL's posttraumatic injuries and sorting and planning them in the therapy programs for a fast recovery avoiding inner joint adhesions and joint rigidity.

Method and material

To gain results as objective as posible there were selected 5 subjects with complex knee injuries, whom, aside ACL injuries also showed associated injuries of knee caps, collateral ligament, posterior cruciate ligament, patelo-femural ligament. After the ACL reconstruction the first two patients were treated with ligament plasties, the 3rd patient is in recovery after the reinsertion of the collateral extern ligament on the fibular head and prepares the ground for a new intervention regarding ACL's ligament plasty. The last two patients are in recovery after injury in preoperative preparation. Some patients show ligament hiperlaxity and the others ligmanet hipolaxity. All activity took place during 11 months between july 2013 – may 2014. Kinetic treatment implementation takes into account every's subject particularity following the individualization, progressivity and treatment continuity principle.

Researched subjects

Tabel nr. 1 *Researched subjects*

Initials	Sex	Age	Clinic Diagnosis	Proffesion
C. R.	Male	21	Cronic Anterior Instability Right Knee	student
N.D	Male	22	ACL reconstruction with semitendinosus tendon and gracilis. Intraarticular lavage. Partial senovectomy.	Handball Player
L.E	Female	41	Right Knee ACL rupture. Trill nefarious pentadic.	professor
Ţ.B.	Male	26	High degree ACL rupture. 2nd degree LCM injury. Fibrillar damage of patelo-medial femural ligament.	skier
I. M.	Female	17	Right knee injury with incomplete extension. Ligament hiperlaxity.	student

Used Methods

A series of methods had been used during the research aimed to ensure the scientific fundation of this theme and also to gather, record and process the data obtained.

Subjects functional evaluation

The functional evaluation covered the hypotrophy evaluation through comparative mesurement of girth: left – right thigh, left – right calf; pain evaluation through VAS visual scale; motion range evaluation; muscle force evaluation; and functional level evaluation.[*3*4*9*10]

Kinetotherapeutic Intervention targeted the pain relief, motion range recovery, knee stability recovery, muscular balance recovery, and also the prevention of joint adhesions and stiffness, algo neurodystrophy.[*4]

Subjects Presentation

1st Patient

C.R.20 years old, male, diagnosis:"Right knee cronic anterior instability, ligament plasty BTB type?"

Kinetic treatment was applied to relieve the pain, infalmmation, edema, restore the motion range, joint stability and muscle force diminished by the injury.

Phase I- immediate post surgery aims pain and inflammation relieve, increase mobility and fights off muscular atrophy.

Means and methods of treatment: joint rest –fixed splint, criotherapy, DD antideclive posturewith a pillow beneth the calf, asuplizant massage, electrostimulations especially quads.

Pasive mobilisations auto-pasive mobilisations, active exercises and active exercises with resistors.

Phase II secondary to post surgery (day 21-45), is the essential phase of intensive recoveryalthough the fixation points and plasty are fragile. Flexion growth to 120 degrees is aimed.

Means and methods:plural daily criotherapy, periarticular massgein all planes, profound transversal massage on colateral ligaments, pasive mobilisations,active mobilisations, active exercises, hidrokinetotherapy.

Phase III, after 45th day. The objectives are proprioceptive re-education and effort retraining, muscular strenght grawth and coordination, proprioceptive stimulation with weights and unipodassistance and complete motion range.

Means and methods used: criotherapy after each treatment session, stimulating massage of the areas with low muscular tonus, quads and calf stretching, active mobilisations, general phisical training which includes swimming, bicycle with progresive charging, knee extension exercises with the multifunctional machine. [*5*7*8]

2nd Pacient

N.D., 22 years, male., diagnosis: "ACL reconstruction with semitendinosus tendon and gracilis. Intraarticular lavage. Partial senovectomy."

Phase I 0-3 weeks, aims the pain relieve, knee cap mobilization, mobility growth of the hip join, progressive growth of the motion range.

Specific directions: walking with assistance of two canandian crutches;

Means and methods folosite: joint rest, criotherapy, antidecliv posture,analgesic and decontracturant electrotherapy, massage, knee cap pasive mobilizations, knee pasive extensions focused on complete extension, hip extensions, knee and ankle small range active extentions, the repetition number grows gradually. Active mobilizationswith resistance, FNP techniques: Rhythmic initiations (RI), RhythmicStabilisation (RS), hidrokinesiotherapy;

In the first 3 weeks walking is performed without load and with crotches assistance, after which it progresses to gradually loading to full load of lower limb affected by surgery.

Plaque destabilisation proprioceptive programm is started for both feet and progressed to a single foot through balance exercises.

Phase II – aims pain relief, complete recovery of motion range andmuscular strenght recovery.

Kinesiotherapeutic intervention covers: relaxing massage, lenghtening postures for quads, hamstrings, sural triceps. Auto-pasive mobilizations which use body weight on presses for the lower limb, reversed squats with small loads and many repetion are done. Active mobilizations with open global kinetic chain, gradual progress to closed kinetic chain exercises. Proprioceptive and neuromuscular facilitation techniques (PNF): rhythmic initiations (RI), Slow Reversal(SR) – for motion range growth, slow reversal with opposition (SRO), repeated contractions (RC), sequential strenghtening(SS) for force growth. Hidrokinesiotherapy intensifies water exercises, swimming lenght grows with each session.[*12*13]

Phase III – after 60th day – objectives: motion range complete recovery, muscular force growth, muscular strenght growth, both feet walking rehabilitation.

Means used: stimulating massage on hypotonic areas, deep transversal massage (DTM) on collateral ligaments, active mobilizations, the exercises from the previous phase are continued, but the speed, strenght and repetition number are increased.

Active mobilization with resistance use NPF techniques performed on Kabat diagonals for lower limbs (LL): D1F, D1E, D2F, D2E. Dynamic streching in download is performed after the strenght growth exercises followed by relaxing techniques and active movements.

Proprioceptive muscular work – special plates imbalances are performed, first in bipodal assistance and then unipodal. The exercises are hardend by imbalances with eyes closed or by cactching a ball while performing them. Walking exercises: in this phase flat surface, slope, uphill, downhill, and off - road walking is performed.

Going up and down the stairs exercises are performed also. Front, back and lateral both feet jumping exercises. After 3 months they can move to a single foot jump. Pliometric exercises are introduced.

3rd Pacient

L.E., 41 years, female; diagnosis: "Right Knee ACL rupture. Trill nefarious pentadic.". It had been surgical intervened and practiced extern collateral ligament reinsertion on the fibular head. It is shown for recovery, recovery of the motion range flexion to 90 degrees, and for a 2nd surgery for arthrostopic plasty of the ACL ligament.

During the 3 phases kinesiotherapeutic intervention aims pain and edema relieve, motion range recovery, static and dynamic knee stability regain and before injury muscular force recovery.

The programm was staged as following:

Phase I (0-21 days) aims pain and inflamation relieve, knee cap mobilization, knee mobilization between 0-90 degrees, hip joint mobility growth.

Specific directions: walking with canandian crutches;

Means and methods folosite: joint rest – fixed knee brace, criotherapy several times per day, knee local massage, quadriceps izometric contractions, antideclive posture with a pillow beneth the knee, calf and thigh lymphatic drainage, knee cap pasive mobilizations, knee pasive-active mobilizations, curls, extensions,thigh and ankle active mobilizations.

Phase II – (21- 45 days) kinesiotherapeutic intervention continues through massage, deep transversal massage (DTM), quadriceps and sural triceps izometric contractions, electrostimulation, knee autopasive mobilizations, ankle, knee and hip's active mobilizations from Ventral Decubit, plantar flexion, foot's dorsal flexion with the foot outside the treatment table, knee'sflexion – extension, hip's extension and abduction – adduction, knee's flexion-extension through pulley therapy at Rocher cage, PNF techniques:SRO, hold relax (HR), RC, active hold-relax movement (AHRM), RS; hidrokinesiotherapy;[*12*13]

Phase III – stimulative massage is used, streching, active mobilizations with resistence, PNF techniques:SRO, HR, AHRM, RS; exercise bike exercises with light load and growth of the flexion angle, foot and hip position on the machine are closely observed and incorrect moves are not accepted.

Walking exercises – correct walking with assistance without hobble.

4th Pacient

Ț. B., 26 years, male, diagnosis: "High degree ACL rupture. 2nd degree LCM injury. Fibrillar damage of patelo-medial femural ligament."

Objectives for all 3 phases of kinesiotherapy: pain relief, edema minimisation, total motion range recovery, strenghtening and toning of the quadriceps and hamstrings, lameness removal.

Phase I (0 - 2 weeks) uses: criotherapy, lymphatic drainage, izometric contractions, positioning, knee cap's pasive mobilizations, auto-pasive mobilizations, thigh and ankle active mobilizations.

Phase II (2-4 weeks) continues with: massage, deep transversal massage, antalgic electrotherapy, auto – pasive mobilizations, active mobilizations, PNF techniques: SRO, CR, SS, hidrokinesiotherapy.

Phase III (4-6 weeks) has as a specific indication the replacement of the controling orthosis with a funcional orthosis and uses as means of intervention the decontracturant, active mobilizations, active mobilizations with resistance, PNF techniques: SRO, RC, SS, RS, proprioceptive exercises, gait and running exercises.

5th Pacient

I.M., 17 years, female, diagnosis "Right knee injury with incomplete extension. Ligament hiperlaxity."

Objectives: pain and inflammatory process relieve, vicious posture prevention and fight, joint realignment, range of motion (ROM) recovery, muscular strength recovery, bipod and uniped stability regain.

Means and techniques appliend in the recovery programm:

Phase I- antalgic electrotherapy, toning massage și deep transversal massage, stretching, pasive mobilizations, pasive-active mobilizations, thigh and ankle active mobilizations.

Phase II – electrostimulation, izometric contractions, active mobilizations, active mobilizations with resistance, PNF techniques: SRO,SR, alternate isometry (Ais), SS., hidrokinesiotherapy.

Phase III – stimulating massage, DTM, active mobilizations, active mobilizations with resistence, PNF techniques (SRO, AIs, SS, SN), proprioceptive exercises, gait and running exercises.

Results

Results analysis for these 5 patients was done through comparison of the obtained values in preliminary, intermediate and final tests.

At the initial testing the visual examination showed edema presence, swelling, quadriceps hypotrophy, joint larger in volume for all 5 patients. At diagnosis test of the initial testing it been discovered positive Lachman test, positive anterior drawer test, the other laxity tests were negative for **C.R., N.D.,** and **I.M.**patients. **L.E.**

patient had on initial testing a positive Lachman test, a positive anterior drawer test, negative lateral laxity and positive posterior laxity. For the **T.B.**patient in the initial testing was found a positive Lachman test, a positive anterior drawer test, positive lateral laxity and negative posterior laxity. At the final testing all this are negative due to lower limb stability improvement.

Lower limb mesurements took into account the compared thigh circumference (left - right), compared calf circumference (left - right), graphically displayed for all 5 patients.

After the final tests it was found an edema reduction and hipotrophy at thigh and calf level, recorded values differ from one patient to another depending on the body-build and recovery period, values shown in the 1st figure (muscular hipotrophy).

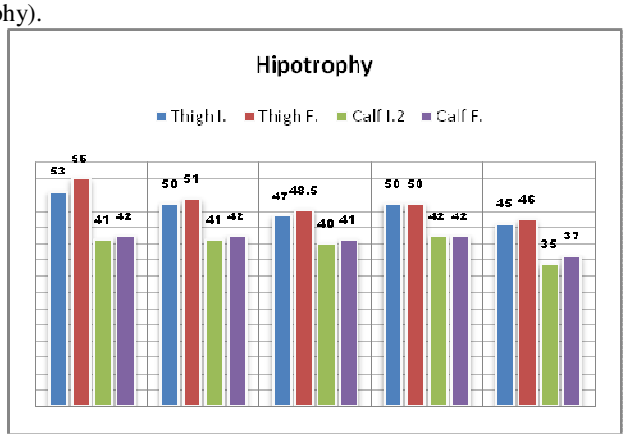

Figure 1.Muscular Hipotrophy

At final pain evaluation it has been observed a significant remission for all the patients included in this study. After performing the recovery kinetic treatment the pain was gone for two of the patients, and maintaining at values of 2 and 3, for the patients who had suffered multiple injuries, a discomfort occurs especially at overstraining.

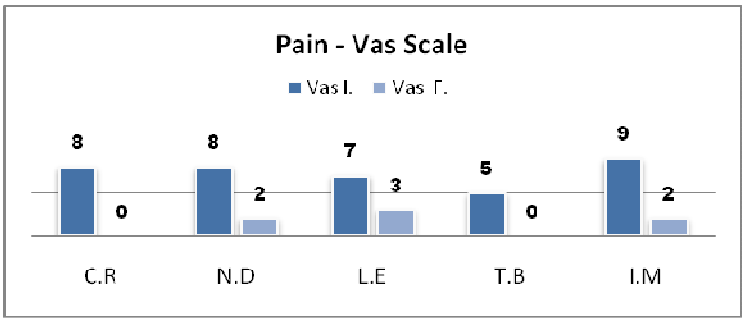

Figure 2. Pain - Vas Scale

In the final testing joint mobility at knee's flexion is close to the normal values, L.E. patient having a range limitation whom has a knee cap joint blockage and whom was programmed to have another surgery for the ACL reconstruction.

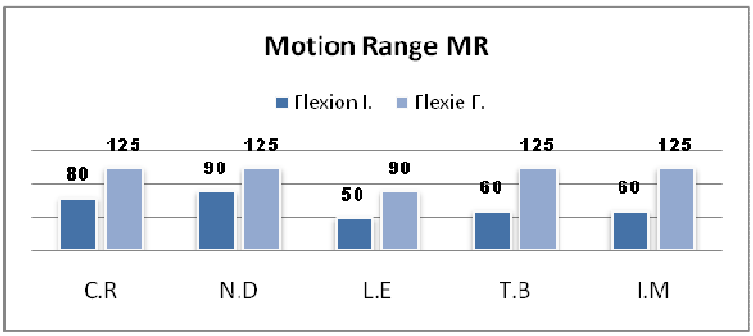

Figure 3. Flexion comparative chart

Final evaluation of the Knee strenght, mesured by scale method, indicate higher extension values compared with knee flexors, obtained results agree with data from literature.

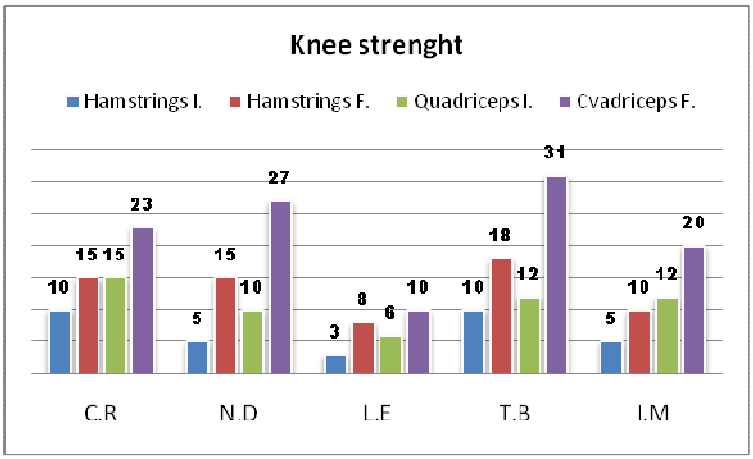

Figure 4. Knee strenght comparative chart

A comparison between patients' force couldn't be possible because it varies by age, sex, training degree, and injury type. During the final evaluation of the global functional index, it had been observed a growth of knee functionality for all the tested patients.

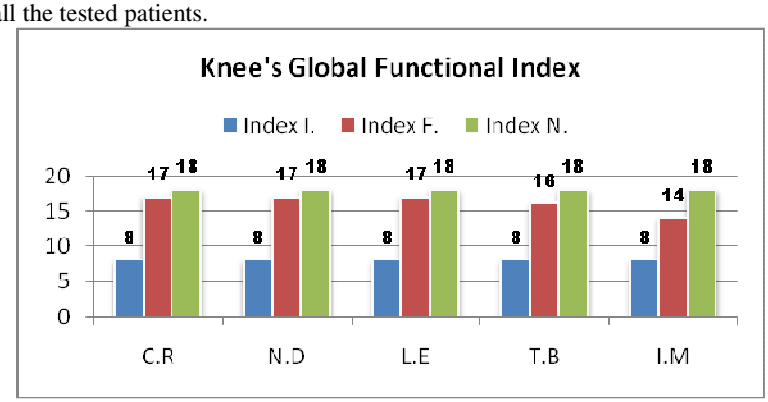

Figure 5. Knee's functionalities

Following the research and data processing means and methods, effects used for pain and inflamations relieve, motion range regain, muscular force recovery, knee's stability recovery for studied patients, stand out.

Conclusions

Kinesiotherapy is a physical treatment mean that can't be replaced by anyother recovery mean. It ocuppies a central place in functional recovery. Kinesiotherapy enhances and strenghtens the effects of massage and physiotherapy.

Designed recovery programms brought to decresed pain values, accelerated resorption of inflammatory processes, muscular force and strenght recovery, motion control and stability recovery of lower limb.

Normal resistance exercises aplied for muscular force growth are easely accepted by patient because they can be graduated to the pain limit. Through kinesiotherapy knee's morpho-functional parameters evolution, for patients with traumatic injuries of the anterior cruciated ligament, tend to phisiologic values.

Bibliography

1. Angelescu,N., „Treaty of surgical pathology", Medical Publishing, Bucharest,2003
2. Antonescu,D., „Musculoskeletal pathology", Medical Publishing, Bucharest, 2006
3. Balint,T., Diaconu,I., Moise,A., „Musculoskeletalrating", Pim Publishing, Iaşi, 2007
4. Bratu,M., „Physical therapy in post-traumatic disorders of athletes", Bren Publishing, Bucharest 2004
5. Brotzman Brent S., Wilk Kevin E., „Handbook Of Orthopedic Rehabilitation", Philadelphia System, Toronto, 1995
6. Dan, M., Marcu,V., „Physical Therapy Manual", Oradea University Publishing, 2010
7. Hertling D., Kessler,R., „Management of Common Musculoskeletal Disorders Physical Therapy Principles And Methods", Third Edition, Publishing Lippincott Wiliams & Wilkins, USA, 2006
8. Johnson Don, MD „ACL Made Simple", Carleton University and University of Ottawa, Ontario, Canada,2003
9. Manole,V., Manole,L., „Motor and functional assessment in physical therapy", Pim Publishing, Iaşi, 2009
10. Manole,V., „Physical therapy in sport performance disorders", Pim Publishing, Iaşi, 2009
11. Munteanu,F., Botez,P., „Musculoskeletal biomechanics", Volumul 1,VenusPublishing, 2006
12.Ochiană,G., „Physical therapy in musculoskeletal disorders", Course, Bacău, 2013
13. Ochiană,G., „Neuroproprioceptivefacilitation techniques", Course, Bacău, 2010
14. Sbenghe,T., „Prophylactic , therapeutic and rehabilitation physical therapy", MedicalPublishing, Bucharest, 1987
15. Sbenghe,T., „Medical rehabilitation of traumatic limb", MedicalPublishing, Bucharest, 1981