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PH.D. SCHOOL

PH. D. THESIS

**STRATEGY OF KINETIC RECOVERY OF THE KNEE AFTER THE
ANTERIOR CRUCIATE LIGAMENT INJURY AND ITS
RECONSTRUCTION WITH AUTOLOGOUS GRAFT AT
PERFORMANCE ATHLETES SPORTSMEN**

Thesis Synopsis

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Introduction

In all the knee traumas, the anterior cruciate ligament (ACL) is one of the most frequently injured structures. This ligament has a key role in the knee function, being one of the major joint stabilisers and the principal opponent of the anterior slipping of tibia on the femur and of its external rotation. Diagnosing the injury at this ligament is of major importance in prescribing a treatment, given that its injury induces joint instability on long term and secondary injuries of the menisci and femur-tibia-patellar covering cartilages and collateral ligaments.

When the anterior cruciate ligament (ACL) is injured, the surgical treatment by arthroscopic reconstruction of a neo-ligament is considered the “golden standard”, particularly at young patients who perform sports activities (50). The functional recovery of the knee subsequent to the anterior cruciate ligament (ACL) injury has progressed relatively rapidly and globally in the latest 25 years (36, 45). The progress made in the arthroscopic reconstruction with autologous graft and in the techniques of reconstructions and graft fixation methods, has permitted the creation of accelerated functional recovery programs, so that the athletes who were subject to this surgery could recover and come back to their initial sport level, more by recovery differences than by surgical procedure (16, 44, 45).

In our study, the knee joint functional recovery programme subsequent to a complete rupture of the ACL, which required arthroscopic surgery for the reconstruction of a neo-ligament, was created and made on the basis of the most recent data from the specialty literature, containing the essential principles of ACL recovery, adapted in such a way so that the football player may come back on the field in the shortest time possible. For all the athletes – the patients of this study – we have used a pre- and post-surgery functional accelerated recovery programme, in stages, progressively in relation to the time elapsed since the surgical reconstruction of the anterior cruciate neo-ligament.

Structure of the Thesis

The Ph.D. thesis, entitled: *“Strategy of Kinetic Recovery of the Knee after the Anterior Cruciate Ligament Injury and its Reconstruction by Autologous Graft at Performance Athletes”* is structured in accordance with the Regulation for the organisation of the Doctoral Studies, issued by the National University of Physical Education and (2016), in three parts, with 13 chapters, figures, tables, the references and two annexes.

PART I - THEORETICAL RESEARCH

PART II-PRELIMINARY RESEARCH. FUNCTIONAL KNEE RECONSTRUCTION AFTER RECOVERY ANTERIOR CRUCIATE LIGAMENT. STAGE INTO HALL OF PHYSICAL THERAPY

PART III. FINAL RESEARCH. SPECIFIC FUNCTIONAL RECOVERY STAGE PLAYERS FOOTBALL FIELD. PERSONAL CONTRIBUTIONS

The first part, *“Theoretic research”* comprises six chapters and represents approximately 27% of the entire thesis. In first chapter we present the methodological approach of the study, structured in chapters rendering the motivation for choosing the theme, premises, goal, purpose, hypothesis and research stages. In the context of the rupture anterior cruciate ligament (ACL) associates in over 80% of the damage concomitant other anatomical structures such as menisci, collateral ligaments, cartilage and cruciate ligament posterior (LIP), I considered the presentation in chapter two of update according to data from recent literature, the classification structures knee stability, in relation to their contribution to the joint biomechanics in six compartments peripheral and central compartment represented by the cruciate ligaments. In Chapter 3 we presented current data on the biomechanics of the knee joint contribution segmenelor bone and ligamentous system in flexion and extension, rotation, rotation of the screw-nut, laterality movements and anterior displacement posteroara. In Chapter 4 presents the macroscopic and functional anatomy and biomechanics of anterior cruciate ligament (ACL) with implications for functional recovery after knee reconstruction LIA. Date specialty literature on recent advances in functional recovery of the knee joint by arthroscopic cruciate ligament reconstruction previous and recovery criteria for progression to return to sports activity, are presented in Chapter 5. In chapter six we presented the innovations and conclusions drawn from preliminary research.

Part II *“ Preliminary Research. The recovering knee joint after anterior cruciate ligament reconstruction. Stage into hall of physical therapy”*

includes 3 chapters: Materials and methods; Clinical and functional evaluation of the knee joint; Measure results to move towards recovery on the sports field; discussions; conclusions;

Chapter 7 contains the material and the method used and subsections, organization and conduct of the study, the recovery program applied study group, preoperative and postoperative recovery recovery.

Part II “Researches Regarding the Functional Recovery of Knee Joint. The Kinesiotherapy Room Stage” has 4 chapters; *Methodologic Approach of the Study, Material and Method, Clinic-functional Assessment of the Knee Joint in View to Start the Recovery on the Field. Results, Discussion, Conclusions.*

Chapter 7 *Methodologic Approach of the Study* is, on its turn, structured in sub-chapters which present the purpose and hypothesis of the study, the rationale of choosing this topic and the stages of the research project

Chapter 8 contains the material and method used in our study, and has the following sub-chapters: *the organisation and progress of the study, the recovery programme applied to the athletes, the preoperative and postoperative recovery.* The paper is a prospective study made in the period March 2012 – October 2015. Out of a total number of 57 patients – athletes from various sports, who received treatment by knee functional recovery, subsequent to an arthroscopic reconstruction of the anterior cruciate ligament, we have selected 37 athletes, football players, 12 playing in the 1st league, 14 playing in the 2nd league, and 11 playing in the 3rd league, who suffered from an acute traumatism of the knee, resulting in complete acute rupture of the anterior cruciate ligament (ACL), to whom a neo-ligament was reconstructed.

The patients’ age limits were between 18 and 35 years old, an average of 25.5. The right knee was injured at 23 patients (62%) and the left knee, at 14 patients (38%).

The study took place in the fitness room and at the swimming pool of the Steaua Bucharest Football Club (SBFC) and on the football fields of the club. All the patients were informed on the necessity of the surgery for the reconstruction of a neo-ligament and the surgery was explained to them in detail, as well as they were told about the protocol of functional recovery of the operated knee, the stages of the recovery process and their length, in relation to the achievement of the targets aimed at. The arthroscopic reconstruction surgery of the ruptured anterior cruciate ligament was made by an orthopaedist surgeon, a primary care physician with competence in sports arthroscopy and traumatology, with more than 10 years of experience.

Our recovery programme had three stages, in order to reach the proposed targets and to progressively achieve them:

- preoperative recovery stage

- postoperative recovery stage, in the gym

- postoperative recovery specific stage in sport, on the field

Preoperative recovery

The athletes with pains, knee tumefaction and limitation of flexion and extension movements, were prescribed a preoperative functional recovery programme, the ACL reconstruction intervention being postponed until the decrease of the pain, the resorption of the joint fluid, resumption of the normal parameters of the thigh circumference, measured at 2.5 cm above the upper pole of the knee patella and when the flexion and extension movements became normal.

The knee recovery began immediately after the ACL rupture at 11 (28%) athletes. The targets of the postoperative recovery programme were: the decrease of the inflammation, of the tumefaction and pain, the resumption of joint mobility, particularly of extension and gradually of knee flexion, the regaining of voluntary muscular activity, the prevention of muscle atrophy before the surgical intervention, the walk normalisation, the mental preparation of the athlete for surgery and the postoperative recovery programme. In order to reduce tumefaction and pain, a bag of ice or gel or a compression bandage filled with iced water was applied to the injured knee of the patients for 20 minutes every other hour. The preoperative recovery stage also included advising the patient on the recovery approach concepts, on the steps of the surgical intervention, on the expectations and targets of the postoperative recovery.

In order to *regain the joint mobility*, each athlete had the following programme: passive flexion and extension exercise, patella mobilisation, balance of the shank at the border of the table, “wall slides”, flexion of the shank by means of a roller or a ball, maintaining it in the maximum flexion point, stretching, PNF.

The final target of the preoperative recovery was that every patient would recover at least 90% of the force of quadriceps muscle and hamstrings, before the surgery. The preoperative stage was progressive, during a timespan of 14 - 27 days.

Postoperative recovery

All the 37 patients were operated for the ACL reconstruction in the first 4 weeks after the traumatism. The intervals of time between the trauma and the surgery were different, in relation to the symptoms and clinical post-traumatism status of each athlete.

In order to achieve the study’s target of knee joint functional recovery after the reconstruction of the ACL (R-ACL), accelerated recovery programmes were

created for each athlete, depending on the type of the anterior cruciate ligament injury, isolated, without associated injuries, or with concomitant injuries of meniscus or femoral or tibia covering cartilage. Three studies were made: the *1st study* was made on 18 athletes (48%) with acute isolated ACL injury, without affecting other knee structures; the *2nd study* was made on 12 athletes (32%), with acute ACL injury, associated with a rupture of a medial or lateral meniscus, of grade 3; the *3rd study* was made on 7 athletes (19%), with acute ACL injury, associated with medial or lateral femoral and/or tibia condyle cartilage injury, of grade 2-3.

The postoperative functional recovery programme took place 24 weeks (for 6 months) and had two stages: the **first stage** took place in the kinesiotherapy room and in the swimming pool, starting from the 1st day post-op and until the 12th – 14th week; the **second stage** took place on the football field, under the supervision of the kinesiotherapist, in the weeks 12-14 – until the recommencement of the sports activity, approximately 20-26 weeks.

Each stage had targets and suggestions of physical therapy exercises for the recovery of more functional parameters of the knee joint.

Stage of functional recovery in the kinesiotherapy room. A wide range of exercises were made, presented and displayed in the study, for the recovery in the kinesiotherapy room, for the recovery of the joint mobility, the recovery of the force of the quadriceps muscle, the resumption of the patellar mobility, for keeping the tonus of the group of muscles for the operated leg and for the healthy one, for the walk recovery, the development of proprioception, the development of the “Core Stability”, the increase of the effort capacity.

The functional parameters were regained progressively, in three phases: immediate postoperative phase (days 1-7), maximum protection phase (weeks 2-8), moderate protection phase (weeks 9-12).

Each athlete was subject to recovery in the swimming pool, because water’s properties are well known to improve certain functional parameters such as joint movements, running exercises, balance and coordination, as water puts minimum pressure on the operated knee.

Chapter 9 - Clinic-functional Assessment of the Knee Joint in View to Start the Recovery on the Field. Results. Conclusions

Tests for the functional recovery assessment are presented in this chapter, tests that took place in the kinesiotherapy room, for each athlete of the three study lots. Thus, the following tests were performed: complete clinical examination of both knees, performing the Lachman, anterior drawer and pivot-shift stability tests at the beginning of the recovery, in the 2nd, 6th and 12th week postoperative.

- control of the joint tumefaction, using the metrical band to measure the comparative circumference of both knees, at media-patellar level and at 5 cm above the patella, one week and four weeks after the surgery (table no. 7.1.1 of the thesis)
- self-assessment of pain, its severity and frequency, after one week and at the end of the 12th week. In accordance with the recommendations of the International Knee Documentation Committee (IKDC), the pain intensity and frequency is assessed on a scale from 0 to 10 – 0 indicating the absence of pain and 10 indicating the most intense pain; in case of frequency assessment, 0 indicates “no pain”, and 10, constant pain. Each athlete was trained to fill in a form and to answer at some questions related to the degree of pain (table no. 7.1.2 of the thesis)
- assessment of joint mobility, using a goniometer to measure the angles of passive and active flexion of the operated knee, in comparison to the healthy knee, 14 days and 12 weeks post surgery (table no. 7.1.3 of the thesis)
- comparative assessment of the volume of thigh muscles (degree of atrophy and hypertrophy of the quadriceps muscle), using the metric band to measure the circumference of the thigh of both knees, 5, 15 and 23 cm above the patella, 4, 8 and 12 weeks post surgery.
- assessment of the force of the quadriceps muscle and hamstrings at the end of the 12th week of recovery, by means of the isokinetic test at 90° and 180° and by comparing the values of the relative muscular couple (CM), measured in Newton / meters/kg (Nm/kg) obtained for the extensor muscles (quadriceps) and hamstrings muscles, at the operated and health knee (table no. 7.1.6 of the thesis).

The table no. 9.1.7 contains the time intervals when the athletes of the three studies fulfilled the criteria for passing at the next stage, of field recovery

Study Lot	Week 13	Week 14	Week 15
1 st study (18 athletes)	18 (100%)	0	0
2 nd study (12 athletes)	10(83%)	0	2
3 rd study (7 athletes)	3 (40%)	1	3
Total	31 (84%)	1 (3%)	5 (13%)

Per total, from the entire lot of 37 athletes, 84% fulfilled the criteria of passing to the recovery on the field, 1 (3%) and 5 (13%) required the postponement of the recovery on the field with one week and two weeks, respectively. The results of the knee functional recovery in the kinesiotherapy room are in agreement with the results of the studies made in the specialty literature (45, 47, 76, 77).

Part III - Researches regarding the Functional Recovery in Sport, specific to Football Players. Personal Contributions

In order to qualify for the functional recovery training in sport, specifically on the field, the athletes of the three studies fulfilled the following clinical criteria: no joint instability at the Lachman, anterior drawer and pivot-shift clinical tests, no spontaneous pain and no pain at joint movements (analogous visual scale 0), complete absence of joint tumefaction GMA (full extension <10 ° deficit of flexion compared to the healthy limb)

All the athletes of the three studies were involved in the final stage of the knee joint functional recovery, after the ACL reconstruction, on a football field, with grass or synthetic grass, depending on the weather. Each recovery session lasted for 60-90 minutes and was performed for 6 days/week, under personal supervision. Each session was in the air, on a grass field, or inside, on a synthetic field.

Phases of field recovery

The stage of functional recovery on the field had three phases: 1st phase – controlled training, 2nd phase – intensive training and 3rd phase – return to the competitive activities.

Well defined exercises were performed in each phase, progressively, specific to the football game. Passing from one phase to the other was made by means of the orthopaedist physician, depending on the achievement of the performance parameters of the knee joints. *1st phase - individual controlled training.* The athlete started running on the field in a slow rhythm, two sessions of 10 minutes each. The running programme evolved step by step, if the athlete did not accuse pains, joint tumefaction or walk deviations. Correct running and neuromuscular coordination exercises were focused. The athlete also started performing coordination exercises, such as: front running, backward running, lateral running, winding running, coordination and light jumps in lateral and in front, static and dynamic exercises of individual technique, with the ball. The training contained the following series of exercises: *aerobic running, warm-up, exercises for the development of coordination, speed ladder, figure-8 running, backward running, static exercises of individual technique, running in two rhythms 100 m/50 m, jumping over hurdles of 20 cm with one foot and two feet, figure-8 running, kicking the ball, short and medium passes (static and dynamic), circuits of individual technique, running in two rhythms 50 m/50 m, specific exercises for the development of proprioception.* *2nd phase - individual intensive training.* In this phase, the intensity of training sessions increased. We aimed at the increase of the effort capacity, dynamic stability of the knee, capacity to land correctly on the operated leg, development of proprioception, capacity to enter in contact with the adversary, improvement of the

neuromuscular control and assuring a continuous increase, which would finalise by the athlete's returning on the field. Personalised exercises were performed, specific to the position that the athlete has in the team, both from the technical-tactical point of view and from the physical point of view. The training consisted in the following series of exercises: *aerobic running, warm-up, circuits for the development of coordination, agility and rapidity, kicking the ball, medium and long passes, running with change of direction, circuits for the development of the individual technique, jumps over hurdles or cones of 40 cm, with one foot and eccentrically, running in three rhythms 50" / 7" / 3", running with the change of intensity (Fartlek), exercises for the development of proprioception.* 3rd phase – *return to the competitive activities.* The criteria for returning of the athlete on the field, next to his colleagues, were: knee mobility of 100 %, single leg hop test (when the athlete must jump once on the operated leg, 90 % of the hop's length of the healthy leg) – single leg triple hop test (when the athlete must jump three times on the operated leg, 90 % of the hop's length of the healthy leg) and the isokinetic test (where the difference of force between the two legs, agonist – antagonist, must be of maximum 10 – 15 %). If the athlete passes these tests, he may begin training with the team. The results of the two isokinetic tests performed – the first one at the end of the 12th week, when the difference between the healthy limb and the operated limb at the Peak Torque values of the quadriceps muscles was of 18%; the second test was performed at the end of the 20th week, the difference decreased at 10%, value that was accepted as criterion of returning to trainings with the team. Even if the athlete resumes his training with the team, he must be monitored in order to prevent a new accident. Each athlete attended – at least once a week – a programme in the fitness room, to keep the muscular tonus. They also continued the exercises for the development of proprioception in order to decrease the risk of a new injury.

The first return on the field is often crucial. The player must be able, physically and psychologically, to pass from the individual training, when most of the situations are intense, but controllable, to the team training, when the player is exposed to unpredictable situations. In this phase, the player continues performing a specific training, focusing on improving his well-known problems (power, coordination, endurance). The training consisted in the following series of exercises: *aerobic running, warm-up, coordination, circuits of individual technique with finalisation, plyometric exercises, reaction time exercises, kicking the ball into the goal, Fartlek (runs with changing of speed), sprints with change of direction, agility circuits (Illinois Run), agility circuits with medicinal ball, exercises for the development of power (beep run, three lines run), series of effort with adversaries*

(one versus one) when lactic acid builds in the muscles, circuits of explosive force, exercises for the development of dynamic proprioception.

Chapter 11 – *Personal contributions, elements of originality.* I consider the following as being elements of novelty and originality:

-The proposal of the doctoral thesis topic “*Strategy of Kinetic Recovery of the Knee after the Anterior Cruciate Ligament Injury and its Reconstruction by Autologous Graft at High Performance Athletes*” was the result of a research project which I began in 2010 during the period when I prepared the master’s degree studies *in posttraumatic recovery and resilience after an effort* and of my daily activity of physical training and posttraumatic and postoperative recovery of the football players from Steaua Bucharest Football Club and of other athletes from Steaua Bucharest Football Club.

-After a research made in the specialty literature, this paper is the first PhD thesis in Romania that presents a study on the functional recovery of the knee joint after the ACL reconstruction. The PhD thesis has a note of novelty and originality consisting in the structuring of the postoperative recovery programme in two well defined and progressive stages, as follows:

-As regards the *recovery in the kinesiotherapy room*, a wide range of exercises was made, presented and illustrated, grouped separately, for the recovery of the joint mobility, the recovery of the force of the quadriceps muscle, the resumption of the patellar mobility, for keeping the tonus of the group of muscles for the operated leg and for the healthy one, for the walk recovery, the development of proprioception, the development of the “Core Stability”, the increase of the effort capacity.

-Also, each athlete was subject to recovery in the swimming pool, because water’s properties are well known to improve certain functional parameters such as joint movements, running exercises, balance and coordination, as water puts minimum pressure on the operated knee.

-In the stage *on the playground*, we included in the recovery programme therapeutic procedures and exercises specific to the football game, strictly necessary to bring the athlete back to his maximum state of health, at the same time decreasing the risk of another injury. Thus, I integrated and illustrated exercises that might give to the operated knee its functional stability, symmetrically to the healthy knee, postural control, muscular force and strength of the limbs and trunk, which provide skills and techniques specific to the football game, vital components of bringing the athlete at his maximum shape.

-Under chronological aspect, exercises specific to the football game progressed with a series of transitory exercises, aimed at activating gradually the neuromuscular control. At this stage, functional activities of increased level continued, such as: running, jumping, landing, change of direction and pivoting.

After the athlete was able to tolerate long runs without any pains or tumefaction to occur, more difficult agility and plyometric exercises were performed, such as two legs hops, one leg hop, landing on a plyometric box. The training with other players was introduced gradually.

-As the anterior cruciate ligament (ACL) injuries are associated, in more than 80% of the cases (53), to concomitant injury of other anatomic structures, such as menisci, collateral ligaments, cartilage and posterior cruciate ligament, I presented in the Part I, Chapter 1 of the thesis, the knee stability structures, per functional anatomic compartments, in relation with their localisation and their contribution at the joint biomechanics.

-As the posttraumatic postoperative recovery is mainly based on the resumption of the movements of the operated knee joint and on the activation of certain muscular groups (of the thigh, of the shank and of the trunk), knowing in detail the functional anatomy and biomechanics of each composing structure allows the kinesiotherapist to choose the most indicated therapeutic exercises in the recovery process.

-I consider to be original the interest I had in the individual training, in monitoring and assessing the preparation level of each athlete from the study lot in the field stage, as regards the exercises and training specific to a football player, mentioned and illustrated in the thesis.

-I mention that in most of the studies published in the speciality literature, the recovery process stops after the athlete regains his basic functional parameters, his maximum joint movements, the force of his muscular strength, the capacity to run, jump and land, the exercises specific to football game being left to the coaches and athletic trainers (37).

-In our study, the field training of each athlete was supervised and monitored until the fulfilment of the criteria of passing to the competitive activities, the intervals of progress being daily monitored depending on the type of ACL rupture, isolated or associated to meniscus or cartilage injury (see the table 9.2.1).

-Still in the context of thesis' originality, I consider a key aspect of the successful recovery of the professional football player to be the tight collaboration between the kinesiotherapist and the patient athlete. This allowed us to monitor daily the condition of the knee and the progress made and also the optimum suitability of intensity and contents of the recovery programme. A tight cooperation between the athlete, kinesiotherapist, orthopaedist, athletic trainer and coach, represents a decisive factor in the athlete's physical training and coming back to competitive activities.

In Chapter 12 I presented a *case study* where they submitted all data on diagnosis, surgical procedure and modalities of recovery, preoperative, postoperative in hall kinesiology and on the sports field, illustrating therapeutic exercises to return to sports activity

Chapter 13 Conclusions

1) The criterion of selecting a compact lot of 37 football players in order to apply the functional recovery programme had practical bases, specific to the football game, considering the understanding of the physical requirements of the sport and level of the game, which the athlete must go back to, given that football is a tough contact sport, requiring the repetition of difficult movements (sprints, jumps, sudden changes of direction, twists) with short period of recovery.

2) The study was made in the fitness room and in the swimming pool of the Steaua Bucharest Football Club (SBFC) and on the football fields of the club. All the patients were informed on the necessity of the surgery for the reconstruction of a neo-ligament and the surgery was explained to them in detail as well as they were told about the protocol of functional recovery of the operated knee, the stages of the recovery process and their length, in relation to the achievement of the targets aimed at.

3) Considering the targets proposed to aim at and their progressive achievement, our recovery programme had three stages: preoperative recovery stage, for 11 athletes, the postoperative recovery stage in the fitness room and the postoperative recovery on the field, which all the 37 athletes benefited from.

4) The preoperative functional recovery programme was applied to 11 (30%) athletes who, immediately after accident, had pains, knee tumefaction, limitation of the flexion and extension movements, the ACL reconstruction surgery being postponed until the decrease of the pain, oedema and inflammation, the resumption of joint mobility (particularly the knee extension), regaining the control of the quadriceps muscle and walk normalisation.

5) The postoperative functional recovery programme was individualised for each athlete / patient from the study lot and had two stages: *the first stage* was in the kinesiotherapy room and swimming pool and took place during the period of time immediately after the surgery, until the weeks 12-14; *the second stage* was in the open, on the field, and took place between the weeks 12-14 till the resumption of the sports activity, in the weeks 22-26.

6) The thesis contains a wide range of exercises used at the recovery in the kinesiotherapy room, which were presented and illustrated and grouped separately for the recovery of the joint mobility, the recovery of the force of the quadriceps muscle, the resumption of the patellar mobility, for keeping the tonus of the group of muscles for the operated leg and for the healthy one, for the walk recovery, the development of proprioception, the development of the “Core Stability”, the increase of the effort capacity.

7) In the stage *on the playground*, we included in the recovery programme therapeutic procedures and exercises specific to the football game, strictly necessary to bring the athlete back to his maximum state of health, at the same time decreasing the risk of another injury. Thus, I integrated and illustrated in the thesis exercises that might give to the operated knee its functional stability, symmetrically to the healthy knee, postural control, muscular force and strength of the limbs and trunk, which provide skills and techniques specific to the football game, vital components of bringing the athlete at his maximum shape.

8) In our study, all the 18 athletes included in the 1st study, with acute ACL rupture, without meniscus – chondral associated injuries, began the recovery on field in the 13th week after the surgery, five athletes, two of them belonging to the 2nd study, who had 3rd degree associated injuries of menisci, and other three athletes from the 3rd study, with associated cartilage injuries did not succeed in progressing, as regards flexion and extension movements and had difficulties at the initiation of quadriceps contraction after the second week after the surgery. These athletes with flexion and extension deficits were examined by the orthopaedist and their recovery programme was modified, their coming back on the field training being extended with two weeks, starting their field recover in the 15th week.

9) I have considered that the resumption of the competitive activities represents the most important indicator of the efficiency of the knee joint functional recovery after the reconstruction of the anterior cruciate ligament. Therefore, from the 37 athletes of the three study lots, 21 (57%) of them (*14 from the 1st study, 5 from the 2nd study and 2 from the 3rd study*) resumed their competitive activity in the 22nd week. 12 athletes resumed their competitive activity in the 24th week after the surgery (4 from the 1st study, 5 from the 2nd study and 3 from the 3rd study) and 4 athletes (2 from the 2nd study and 2 from the 3rd study) came back on field in the 26th week. The results of the knee functional recovery are in agreement with the results of the specialty literature studies.

10) We consider that a key aspect of the successful recovery of the professional football player is the tight collaboration between the kinesiologist and the patient - athlete. This allowed us to monitor daily the condition of the knee and the progress made and also the optimum suitability of intensity and contents of the recovery programme. A tight cooperation between the athlete, kinesiologist, orthopaedist, athletic trainer and coach, represents a decisive factor in the athlete's physical training and coming back to competitive activities.

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