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ORIGINAL RESEARCH

CURRENT LANDMARKS IN THE ATHLETES' RECOVERY WITH MENISCO-LIGAMENTARY INJURIES

Corina Predescu¹, Anca Ionescu², Adela Apostol², Brandusa Mitoiu²¹National Academy of Physical Education and Sport, Bucharest, Roumania²University of Medicine and Pharmacy "Carol Davila", Bucharest, Roumania**The phases, the objectives and the means used in the athletes' recovery**

For over 30 years the recovery and reeducation post - surgery protocols are being adapted to the progress made in the field of surgical techniques. The surgical revolution of the meniscal and ligament pathology, determined by the use of the arthroscope was followed by a new approach of the recovery of patients with meniscectomy with or without associated ligamentoplasty

From the theoretical point of view, the reeducation has to allow stimulations which would favor the reformation of the collagen fibres in the injured structures. In practice, though, the goal of the recovery process aims at a stable and functional knee, which allows the reintegration of the athlete in the training and competition activities as soon as possible, being known that the removal from the competitive activities has a negative impact all the more powerful if the inactivity is longer..

The arthroscopy, through the minimal suffering inflicted, allows a much quicker resumption of activity compared to the classical meniscectomy. This was, actually, the major argument for using this surgical technique with performance athletes, and afterwards in major population.

There are many recovery protocols. Some of them are conservatory (24, 69, 89), whilst others are extremely aggressive, accelerated (10, 219, 221). The general opinion tends towards an active reeducation with the fast and complete recovery of the extension (170, 175). All aim toward the same thing: the return of the athlete to the competition activity as soon as possible, without the risk of a recurrent injury. In any case, a badly coordinated process of recovery, in a standardized manner, can be dangerous and responsible for unsatisfying results. The means used in the recovery process have to be, therefore, customized to each patient, each type of injury, holding account of the mechanical stress to which the anatomical formations are subjected (177, 218, 245). There are, according to the french authors (176) four phases of the recovery after meniscectomy:

- *the immediate post-operative phase*- it is fundamental for the recovery process, because a correct approach of the patient in this phase allows it's beginning under very good auspices.
- *the recovery phase per se*- usually starts between the 5-th and the 7-th day, but the state of the knee is the one that decides.
- *the complementary reeducation phase* (readjustment to effort)- it fills the void between the end of the recovery phase and the resumption of the athletic activity.
- *the athletic activity resumption phase*.

The anglo-saxon specialty literature (111, 124, 246) only describes three phases:

- *the acute phase*
- *the advanced phase*
- *the athletic activity resumption phase.*

Indifferent of these periodisations, the objectives of the recovery are the same:

- the analgesia of the knee- fighting the pain and the inflammatory phenomena.
- the recovery of the joint's amplitude.
- obtaining joint stability- the recovery of muscle force.
- the proprioceptive reeducation for the purpose of the knee joint structure's readaptation to movement (neuro-motric reprogramming).
- the resumption of the athletic activity within the same parameters as before the injury.

For the sports medicine doctor, as for the coach also, the objective of the athletic activity resumption phase is a priority and is represented by the athlete's recovery and training so that he can face the stress of a competition.

The resumption of athletic activity. The moment that the athlete with simple meniscus injury, or with meniscus injury associated with ligamentary ruptures resumes his activity, is a key moment in his recovery, because a precocious start of the competition activity, when „restitutio ad integrum” wasn't achieved represents a potential danger as far as the injury's recurrence is concerned. It must be taken into consideration, therefore, that not only the removal from activity, but also its precocious start can represent a negative moment. This moment is a controversial subject today, especially because there are 2 contradictory opinions:

The first is represented by the conservatory attitude, which favors the protection and authorises the return in the field after 9-12 months after surgery. The second, authorises the return to training and competition after 4 months.

The studies made by Delay in 2001 (92) show that approximately 40% of the AAOS surgeons authorise the resumption of athletic activity after 6 months. Their number was 74% in 1988. If the meniscal injuries are associated with ligamentary lesions, the process of athletic activity resumption varies according with the surgical technique used in ligamentoplasty (Bone-tendon-bone, Hamstrings). Delay, Feller (108) and Gulick (130) confirm, through their studies the link between the faster comeback on the field and the bone-tendon-bone.

There are certain criteria which allow the precocious comeback on the field and which present variations, related to the practitioner's. We synthesized a few of the specialty opinions concerning the comeback on the field (5, 33, 67, 98, 123) :

- Dry knee, with no pain.
- Full dynamic amplitude, no pain.
- A negative result to the pivot-shift test.
- Muscle force recovered in a 90% ratio, evaluated through isokinetics (compared to the other knee).
- Maximum force and explosive force close to the sport's requirements.
- Symmetry values of 80-90% in the functional tests.
- Residual laxity measured in KT 1000 \leq 3 mm compared to the healthy leg.
- Proprioceptive level according with the maximum performance in activity.
- The possibility of finishing a race on flat field.
- An athlete prepared, mentally and physically for the resumption of competition activity.

Chiang's studies(71) clearly show the stress to which the ligamentary and osteo-tendinous structures are subjected during daily activities (walking on flat field 210N, descending stairs 133N) and athletic activities (squat 71N, running 630N, cycling 27N). The resistance of the transplant in time, though, is little known. If we start from the observation that after a year from surgery, the surgical product presents a mechanical resistance equal to half of that of a normal cruciate ligament (800N), this should be sufficient for bearing the stress determined by the resumption of athletic activity (running, changing directions, jumping). Nevertheless, the neoligament's potentially negative effect incites some surgeons into recommending caution in the resumption of the athletic activity. Knowing the evolution of the neoligament in time is also important, in the view of a correct recovery. It will go, in time, through different phases of adjustment, in which a series of histologic, biochemical and ultrastructure modifications can be observed. After 3 weeks, the neoligament already shows a neovascularisation and a neosinovialisation. Between 12-20 months an increase in the number of fibroblasts can be noticed, followed by a maturation of the collagen, and an increase in vascularisation. After 3 years, we're talking about the ligament phase of the neoligament, when the histological difference between it and the ligament is invisible.(120, 219, 220) For sports and recovery doctors, the histologic modifications are important

concerning the necrosis, revascularisation and maturation phase, which can indicate about the recovery process and the resumption of the athletic activity without risks.

The exercise program has to follow the principle of the Specific Adaptations to Imposed Requirements. This concept is based on the idea that the body will adapt in order to bear the effort and the level of stress to which it is subjected. So the exercises have to try to copy the requirements of the activities solicited from the athlete so that he can resume sports successfully.

In general terms, the comeback to the sports activities for sports in axis without pivot is made 4 months after the surgery, for sports with pivot, but without contact, 6-7 months after surgery, and in sports with contact, 9-12 months after surgery.

For the athlete, training the capacity of effort during the recovery process is very important. It will have to be maintained at optimum parameters in the first phases of the recovery so that in the complementary reeducation phase it can be raised at the values required by the kind of sports practiced. Ergometer training with progressive loading is practiced, also rowing, stepper training, running, beginning 3 weeks after surgery. Bicycle exercises begin when knee flexion reaches 110° and contribute, besides the cardio-vascular maintenance, to the joint grinding and muscle toning. Rowing improves upper limb/lower limb coordination, stresses the flexion movement. The stepper exercises are essential because they prepare the athlete for jumping. During stepper exercises, the quadriceps works as a brake for the knee flexion (eccentric work which has to be well monitored concerning the progress of amplitude and resistance), while the hamstrings don't intervene as flexors of the knee, but as brakes of the knee's flexion.

The recommencing of unspecific sports activities will be made progressively, respecting the adapted evolution of the knee. It starts with easy activities (swimming, velo), in order to progress, in 8-9 months to the sports with pivot, activities increasingly stressful (soccer, handball, basketball). The unspecific sports activities have the features of an endurance effort (low intensity, long duration), and the specific ones are intense and with limited duration.

Swimming can start 2-3 months after the surgery, according to the individual evolution. The order in which the athlete can approach different styles of swimming is: crawl, backstroke and finally, breaststroke.

Cycling can begin in the months 3-4. The training will be done on flat terrain, on short distances, with medium speed. First, the number of kilometres covered will be raised progressively and then the effort is intensified by cycling through varied types of terrain.

Running can be resumed after the check done 4 months after the surgery, even if slow running has already been resumed. There is a precise protocol which comprises: the pre-running phase (walking on flat, then rugged terrain, walking on the balls of the foot, walking on the heels, walking with shifts in direction), the running phase (running on flat, and then progressively varied terrain, with the proper running shoes), straight-line racing, zig-zagging, jumping. The track training is initiated through running on the straight lines and walking in the curves. The intensity will be raised progressively up to the moment when the athlete will succeed in running the whole length of the track. Street-running and, ultimately, running on rough terrain represent the training protocols with the lowest level of control and are introduced as a final stage of the progress in running. The running duration can start with the necessary time for covering 2 miles and can be raised on a weekly basis if pain or edema aren't present. Covering a whole rehabilitation up to the level of running can last for 2-3 months.

The balance stability gaining exercises are executed for developing the knee's reactivity so that the muscles are capable again of answering to the unexpected stress and characteristics of the field. Balancing exercises (on the ground, on the unstable board), rope exercise, plyometrics, skateboarding can be used.

The specific activities refer to exercises featured in the practiced fields of sports: repeating in representation a certain group of specific motric gestures, individualised training, without stress or contact, group training.

Resuming the sports with pivot, without contact, allows the athlete's preparation for resuming much more dangerous techniques from tennis, volleyball, short or long passes in soccer, dribbling. The athlete has to practice also how to break a fall or how to prevent falling through exercises of gliding, plunging (84).

All the while through the recovery process and especially in the phases right before the resumption of competitive activity the athlete has to have a diet corresponding to the stress to which he is exposed, and also proper hydration must be taken into consideration. In that direction, monitoring athletes through quantity and quality analysis of electrolytic loss is recommended (80, 181).

For a better orientation of the recovery protocol, in the table below, a few landmarks at 2, 4, and 6 months are presented. Their value is relative, because every athlete has his own recovery rhythm and the key to a

fast comeback is the realisation of a programme which takes that into consideration, managing, at the same time, to respect certain phases relatively standardised.

The period/evaluation parametres	Amplitude of movement	Clinical exam	Isokinetic test	Recommandation
2 months	-5-100°, monopodal flexion 40-60°, hesitating monopodal jump 0-10cm	Moist knee, slight hyperemia, Lachman test +, heel-buttock distance 20-25 cm, thigh perimetre ≤ 3 cm, cutaneous anaesthesia around the scar, slight hyperaesthesia in the prelevation area		<i>Avoid:</i> prolonged effort, acrobatic holds <i>Resume:</i> running on flat ground, squatting, cycling 2-3 times/week-5 km, pool-walking, crawl-yes, breaststroke-no
4luni	-5-130°, monopodal flexion 70-90°, monopodal jump 40-60 cm	Occasional pain (weather, effort), climbs and descends stairs, resumption of activity	It's done at low speed, 60° and high speed 180°. Shows: flexion deficit $\leq 10\%$, extension deficit $\leq 40\%$, force loss, regulated curves-good prognosis, irregular curves-pain, lack of interest, performances in plateau- the knee-the knee can't take additional loading, incision at the top level at each curve- patellar accrochage	<i>Avoid:</i> neglecting daily training, prolonged effort discouraging, even if not all things are well <i>Resume:</i> running on flat ground, on slope, on sand- perpendicular direction followed by walkin in the water up to knee level, squats, cycling 2-3 times/week-25 km
6 luni	-5-140°, monopodal flexion $\geq 90^\circ$, monopodal jump ≥ 1 m	Dry knee, no pain, heel-buttock distance 15 cm, Lachman test-	Shows: complete recovery of the flexors, extensor deficit $\leq 20\%$, irregular curves.	<i>Avoid:</i> participating in the end of matches, bad fields, entering the game without proper warm-up <i>Resume:</i> sports with pivot, with pivot and contact

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