

# Weight-Bearing Progression for Athletes After Surgery on the Leg

In a modern functional re-education program, special attention should be directed to the initial stage of load recovery for the limb which has undergone surgery. This stage is extremely delicate and can significantly influence the course of rehabilitation.

The aim of this paper is to analyze the criteria and tools which can be adopted in order to define appropriate weight-bearing progression in the variety of situations we are faced with every day with our patients in the gym.

I have deliberately chosen not to analyze the advantages offered by water environments and hydrokinetic therapy, as, in view of their specific nature and importance, they deserve to be treated separately.

## CRITERIA OF CHOICE

When, how, with what we choose to stimulate the patient during rehabilitation are questions which cannot always be easily answered.

First of all, those elements which prove useful to a physiotherapist in correctly planning the therapeutic program must be identified, with special attention directed to load recovery. With the term "load", I refer to body weight being supported by the affected leg, but also to stimulation occasioned by therapeutic exercises for muscle strengthening.

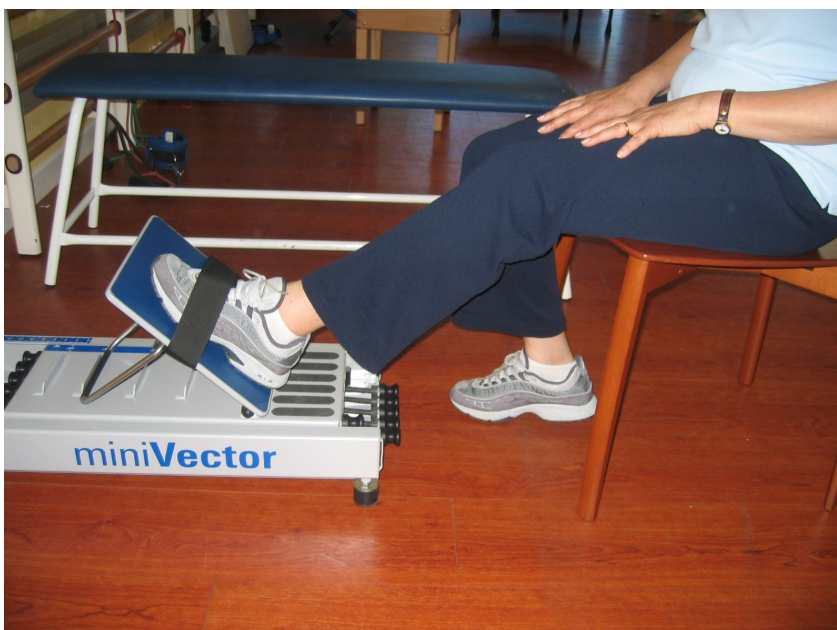
***Indications and recovery schedule prescribed by the surgeon.*** It may go without saying that the surgeon's indications should be taken into account, but, since communication between rehabilitation operators and orthopedic surgeons does not always prove easy, I believe it is crucially important for the re-educator to encourage direct contact with the doctor who carried out the surgical procedure. They are, as a matter of fact, the only person effectively able to know what particular procedures and means of fixation were used and therefore capable of assessing what loads the joint can sustain after surgery.

Another situation which can occur is the scenario in which the schedule prescribed by the surgeon is standardized according to pathology and needs to be tailored to the patient's psychological, physical and athletic situation. Recovery time can actually change even significantly in relation to the patient's response to stimulation. In this case, again, sustained contact with the surgeon is crucial in order to agree on any changes to what is scheduled by standard protocols or to what had emerged during the last check-up.

**Patient's reaction to stimuli.** Each patient is an individual, and their tissues react differently to stimulation. An expert re-educator should therefore also take into account the exercise's metabolic aspects, as well as the patient's lifestyle, motivation and psychological aspects which can affect recovery after injury. For example, our experience with rugby players has taught us how different the capacity and will to undergo pain can be for certain groups of athletes. For us physiotherapists pain is a precious guide, but we are also the ones who have to read the patient's reactions and consider that, based on who is sitting in front of us, this guide can be more or less reliable. From a physiological point of view, in fact, a knee which has undergone chondroplasty needs to be rested and protected for the same amount of time, regardless of whether it belongs to a rugby player or a classical ballet dancer. However, in practice our approach would probably differ with these two athletes, as it would prove difficult not to let ourselves be influenced by the individualities of the person we are caring for.

**Available tools.** Among the many tools available to offer the patient an appropriate weight-bearing progression, we certainly must favor devices which allow closed kinetic chain exercises and offer good load modulation. Among the several leg presses today available, those that employ elastic resistance fulfill these requirements optimally. In particular, an excellent aid for the delicate stage in which the passage from no load to complete load occurs is offered by a recently created device: the **Minivector (Figure 1)**. This simple press works with elastics and can be used by the patient even in their own home. It also offers the chance to work with very light loads which can be easily increased.

The Minivector has six elastics; each offers a resistance of 1 kg to begin with and builds up to 5 kg at the maximum of tension: this allows progressively increasing stimulation of the load on the joint which has undergone surgery, while monitoring its improvements.



**Figure 1 – The MINIVECTOR**

The criteria analyzed above presume that any rehabilitation operator be familiar with the concept of PROGRESSION. I personally believe it to be the foundation of any rehabilitation treatment, regardless of whether the patient is an athlete or sedentary and of what joint is being treated.

The idea of progression is based on the principle that, in re-education, recovery of function should be obtained by seeking to:

- 1) avoid underloading muscle, tendon and joint structures as this would not provide sufficient stimulation to bring about necessary adaptations, ultimately lengthening recovery time;
- 2) avoid overloading, which exposes tissues to functional overload pathologies, such as tendinitis, bursitis and muscle fatigue. This would force the patient to undergo rest periods and further therapies, with an obvious delay in reaching expected functional goals.

Instead, the attempt should be to seek the so-called **area of homeostasis (Figure 2)**. This refers to the situation in which appropriate stimulation for a given moment is put forth, both from a metabolic and reparative point of view, with the advantage that recovery time is optimized by constantly adapting work loads to the patient's condition. It is complex work, as it obliges the re-educator to constantly “read” the patient and adjust their program on an almost daily basis in order to seek out the most appropriate stimulation, the one which has a positive effect on the tissues without damaging them.

By way of example, we will consider a patient who has undergone surgery for a pathology of the knee. To simplify, three distinct phases in which recovery of weight-bearing capacity holds particular importance may be identified.

### 1) PROTECTION PHASE

***Once surgical reparation and/or reconstruction has taken place, a period of non-weight-bearing on the limb which has undergone the procedure must follow to facilitate tissue healing.***

Non-weight-bearing does not mean absence of stimuli. In this first phase, manual stimulation is carried out to ensure that proprioceptive sensitivity and joint position sense are re-established. Exercises against elastic resistance are performed, restricted to the ankle joint and intrinsic muscles of the foot. Patient walks supported by two crutches, no loads allowed while walking.

### 2) TRANSITION PHASE

***This phase is certainly crucial after procedures on cartilage, as this tissue is highly specialized in weight-bearing and, during its healing process, needs to be stimulated in this respect.***

In this second phase, activities with loads are included. These are calculated in terms of body weight percentage. Patient walks with two crutches. Touch-down weight-bearing should give them full awareness of the load on the operated limb. To this end, all exercises on weighing scales can be used, as well as walking on insoles with a telemetry connection to a PC which, once correctly calibrated, allow the desired load to be programmed. If the programmed threshold is exceeded, acoustic feedback can be heard. This enables the patient to gain greater awareness of just how strongly their injured limb is being stimulated.

Subsequently, the patient begins the first exercises which involve pushing on the foot on soft surfaces (such as sponge balls of different consistencies) and against the therapist's manual resistance, as well as with the aid of the Minivector.

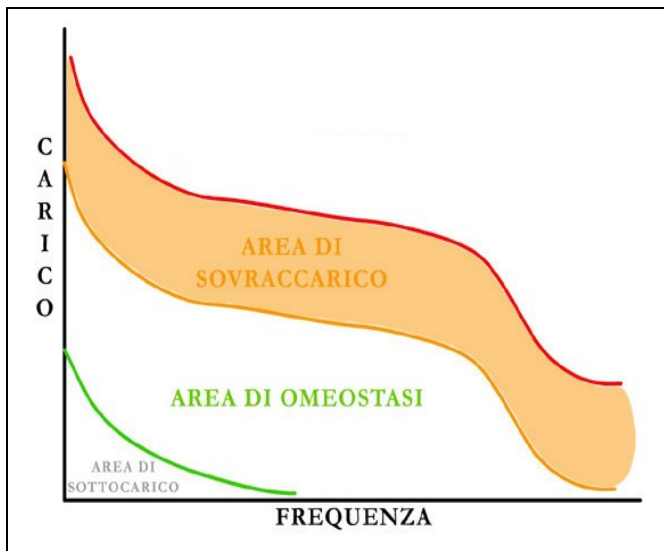
During this second phase, exercises with the patient standing are also recommended, as they prepare the patient to walk without support: walking exercises with one crutch under the physiotherapist's supervision, aerobic training on elliptical machines while leaning on the arms, exercises on step machines. Each of these exercises should be based on a progression which will ultimately lead the patient to full weight-bearing.

### 3) MATURATION PHASE

***Tissues need the chance to reach functional maturation in complete safety, which is possible if the patient has perfect musculature at their disposal.***

This phase comprises recovery of muscle strength, which must occur as careful load progression is followed. To this end, it may be useful to stress that each exercise can be initially performed by also using the contralateral limb. The patient can then move onto monopodal execution at a later stage, provided the joint shows no adverse reactions.

The constant search for the area of homeostasis through ongoing adaptation of work loads allows the re-educator to obtain the best possible results in the shortest time.



**Figure 2 – The area of homeostasis in re-education (in green, frequency on the x-axis and load on the y-axis)**

In order to work within the area of homeostasis, it is useful to know that in fitness gyms beginners (as we can consider our patients to be) obtain the same results as far as trofism and strength increase are concerned with loads equal to 20-40-60% of 1RM. While re-educating, it is therefore advisable to start with loads close to 30% of 1RM as equivalent results can be obtained without the risk of overloading. Vice versa, one must consider that more expert athletes (as we must consider our patients to be at the end of re-education) respond better to stimuli close to 80-90% of 1RM. Therefore, by the end of re-education, we must be able to administer even very intense loads. This ensures real improvement, as opposed to simply maintaining the results obtained up to that point.

Depending on the kind of surgical procedure, the therapist has to assess whether to favor open or closed kinetic chain work, full or reduced joint excursion when performing exercises. Furthermore, each patient's functional and athletic needs must be taken into account in order to direct stimulation to the fulfillment of functional objectives compatible with the characteristics of the sport practiced by the patient.

Parameters to consider each time an exercise is suggested to a patient and the aim is to work within the area of homeostasis:

- Biomechanical impact on the joint.
- Type of contraction required (isometric, concentric, eccentric).
- Full or reduced range of motion (ROM).
- Metabolic requirements.
- Exercise execution speed.
- Correct exercise execution.
- Total volume of loads administered.
- Frequency of stimuli (weekly, daily and within single sessions).
- Time the exercise is administered (beginning or end of session).

### **Table 1 – Essential parameters which must be assessed in order to work within area of homeostasis**

It should be underlined that correct load progression calls not only for increased resistance to be opposed by the machine, but also for more complex movements and greater impact on the joint to be introduced. I am specifically referring to hops and jumps which should also be recommended in the right progression and only when the patient is able to withstand such stimulation.

If, for example, walking on a treadmill exerts a load on the knee equal to 100% of bodyweight, running at a speed of 10km/h can produce a load greater than 500%, and plyometric exercises (with vertical fall) can produce still greater loads. Our patient will have to perform such movements once they return to sport, and, therefore, our task is to accompany them through re-education to confront such stimulation in complete safety. We can begin by recommending bipodalic jumps on the **Vector (Figure 3)** press, which works with elastics, then move on to jumps on a trampoline and finally administer actual plyometric exercises in the gym and on the playing field.

We must underline that muscles also act as shock absorbers for the joints and that, in particular through eccentric contraction, they are capable of absorbing kinetic energy and counteract, or at least reduce, impacting forces produced during especially intense activities. Therefore, focused strengthening of musculature in the eccentric mode should be included in the re-education program.



**Figure 3 – Exercises with load on the Vector**

In conclusion, we can state that, considering the importance of correct load progression in a re-educational program, physiotherapists need to be aware of the entire “array” of devices useful to this end. Above all, they need to develop sensitivity and skill in interpreting any signs the patients show while in re-education in order to constantly work within the area of homeostasis. This grants the physiotherapists the chance to consistently offer patients the correct stimulation. This way of operating usually makes the difference and ensures that patients can recover as well and as quickly as possible!

Marco Zanobbi

Physiotherapist

Isokinetic Rehabilitation Network