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## BENEFITS OF THE PROPRIOCEPTIVE TRAINING IN RECOVERY AFTER KNEE SPRAIN – THEORETICAL GROUNDS

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### Abstract

*Aim:* We intend to make a theoretical review about proprioceptive training and its benefits. The aim of this paper is to realize a brief review on the benefits of the proprioceptive training. Proprioceptive training is used in the rehabilitation after injuries and begins to be recognized as an important element in preventing them, regardless of the sport. We allege that the goal of the proprioceptive training is also to develop muscle strength and neuromuscular control, so that the finality is represented by a better control and a more effective protection of the knee joint during stresses over physical effort.

*Conclusion:* All the papers that we are reviewing have a main conclusion – the proprioceptive training is effective in improving and recovering proprioception. And also in increasing muscular strength and power.

*Key words:* proprioception, proprioceptive training, benefits of proprioceptive training, recovery.

### Introduction

Proprioceptive training plays a major role in the rehabilitation and prevention of injuries to the lower limbs. Proprioceptive training is used in the rehabilitation after injuries and begins to be recognized as an important element in preventing them, regardless of the sport. Running, changing direction, jumping and pivoting on one leg arouse the sense of joint position and muscular control for joint stability.

Unfortunately, it is well known that the practice of sport performance often leads to injuries, especially to lower limbs. So injuries in sport have long been a point of interest for researchers. The most frequently encountered and therefore studied are those of the knee joint – sprains, twists or ligament tears (Giofsidou et al., 2012; Hägglund, Waldén, Atroshi, 2009; Soligard, Myklebust et al., 2008; Sugimoto D, Myer GD, et al., 2015; Waldén, Atroshi, et al., 2012; Wingfield, 2013).

Most researches have revealed that proprioceptive exercises are those that should be the focus of athletes' recovery from injuries of the knee joint.

Women are more likely than men to injuries of the knee joint, due to valgus positioning of lower limbs, relatively unbalanced weight distribution and also the center of gravity moved compared to plantar surface when it is ground supported. We should add to these the lower

strength and power compared to men. Also, another explanation of more common accidents in women is the deficit of proprioceptive sense which can lead to a low control in extremities, which causes genu valgum and thus the increased pressure on the knee ligaments.

Myer, et al., 2005 and Zouita et al., 2009 argue that female athletes who include proprioceptive exercises in their training will benefit in terms of strength and neuromuscular control, and increasing the dynamic joint stability (joint stability during movement) and relearning the pattern of movements and skills used while performing daily and sport related activities.

Getting good results in the recovery and prevention of knee injuries, regardless of the treatment applied, cannot take place without sustained and properly conducted functional rehabilitation. And the faster the recovery is, the better the functional results will be.

We allege that the goal of the proprioceptive training is also to develop muscular strength and neuromuscular control, so that the finality is represented by a better control and a more effective protection of the knee joint during stresses over physical effort. The more so as proprioception and coordination are usually neglected in rehabilitation programs, wrongly assuming that the athlete is ready to go back on the ground once she regained the muscular strength and mobility. If

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balance, proprioception and coordination are not fully restored, the risk of relapse significantly increases.

The objective of introducing proprioceptive exercises in athletes' training is to provide a progressive stress of lower limbs muscles, which will close the kinetic chain and determine changes in their neuromuscular system, so as to achieve the elimination of shortcomings/ limitations caused by injury.

Proprioception - overview. 'Proprioception – is the body's ability to transmit a sense of position, analyze that information and react (consciously or unconsciously) to the stimulation with the proper movement' (Houglum, 2001). So, proprioceptive sensitivity is what helps us place ourselves in the space, feel the posture of our body, each limb; thanks to it we are able to harmoniously move, in coordination, consistent with the purpose of the movement, an ability which occurs early and improves once we grow up. (<http://www.descopera.ro/stiinta/9697033-cate-simturi-au-oamenii>)

The term 'proprioception' was introduced by Sherrington, to describe sensory information/ inputs coming during central movement (CNS), from some specific structures: proprioceptors. Their main function is to provide the feedback of own body movements, in other words to indicate, step by step, which are the movements performed by the body (Pellis, 2007).

Although it is an internal subconscious mechanism, proprioception is real, observable and measurable. It may be altered, either temporarily or permanently. When it is lost, it may or may not return automatically. Recovering proprioception takes time, effort and work experience. The easiest way to improve proprioception is the training.

It is well known that proprioception is the key to an increased performance of the athlete, the proprioceptors playing a vital sensorineural role in athletes' motor skills, being the key factors on which depends the athlete's ability to perform actions/movements specific to the practiced sport.

By improving proprioception, we ensure the balance required to maintain stability; agility is improved so that it can change direction rapidly when needed and coordination skills are developed so that the athlete can carry out physical activities correctly and consistently. Besides the immediate effects on speed, balance and strength, there is significant statistical evidence demonstrating that a program for preventing injuries and including proprioceptive techniques lowers the neuromuscular

risk factors and influences the basics of sports performance. Proprioception is very important in injuries recovery. Regarding the risk of recurrence, several studies on different joints noted that this was due to the alteration of proprioception (<http://www.scribd.com/doc/227803314/Prezentare-Pitesti-Ro#scribd>)

Proprioceptive or neuromuscular training is fast gaining attention in sports performance both for prevention and recovery of musculoskeletal injury and for performance increase. It is based on retraining the existing neuromotor programs starting from sensitive information they have given birth, through the implementation of a similar program that emerged from further information and that replaces the previous program, which became outdated or incomplete.

As general ideas, neuromotor training aims to strengthen unconscious motor feedback by stimulating the central control mechanisms of joint dynamics, being designed to induce compensatory changes in muscle activation patterns and to facilitate dynamics joint stability.

It is based on scientific principles of neuromuscular rehabilitation techniques and aims to improve kinesthetic sensitivity, reflexes and stability (<http://www.scribd.com/doc/227803314/Prezentare-Pitesti-Ro#scribd>).

By means of proprioceptive training is attempted to recover the function of injured joint and even to recover all motor schemes necessary to maintain static and dynamic physiological balance of the whole body.

Proprioceptive training is basically neurological reprogramming, a technique that is based on encouraging completely neuromotor system. The main goal of proprioceptive exercises is to re-educate proprioceptive reflexes in order to regain an optimal 'control' over the muscles and movements (Cocucci, Boni, 2005).

As a preventive role, proprioceptive exercises are performed in order to achieve a faster and more automatic control over the muscles, given that during the exercise may occur unpredictable and sometimes violent actions.

These preventive exercises based on progressive ability to resist to imbalances make it possible to support always right the lower limb stimulating the muscles so as to avoid isolated muscle contractions – that is only of some groups of fibers in a given muscle or different combinations of muscle groups. Repeating exercises will lead to safety, speed and precision in performance.



The technique of proprioceptive training relies on mild controlled stress applied on joints involved (in order to rather speed up muscle feedback to absorb the destabilizing effect than injure the joint) using either exercises where the load and natural support is performed on oscillating surfaces (BOSU balls, balance boards etc.) with different degrees of difficulty. The exercises used in this type of training tend to stimulate the proprioceptive systems and nerve centers on which depend the postural balance adjustment (Cocucci, Boni, 2005).

In general, proprioceptive training consists of a set of exercises that create situations of instability, in order to evaluate and improve the use of proprioceptive signals coming from the peripheral parts of the body, especially from the lower limbs. As seen above, the main objective of neuromotor training is to re-educate proprioceptive reflexes, in order to regain an optimal control of posture and affected joints.

Also, this type of training is essential for:

- Full recovery from an injury (to restore reflexes and reactivate all information channels interrupted by the accident);
- In preventing injuries (to have a faster muscular control during exercising and to encourage the stress of whole groups of muscles, avoiding isolated contractions);
- In sports training (to develop the sense of balance and absolute control of movements) (<http://www.my-personaltrainer.it/allenamento/allenamento-proprioceattivo.html>)

Proprioceptive training is performed on 3 levels of activations:

- The bone marrow for training spinal reflexes that mediate patters of movement and promotes joint stability – TRAINING BASED ON SUDDEN CHANGES OF JOINT POSITION
- The level of brainstem corroborating visual, vestibular and proprioceptive information, thus generating balance and postural control – REEDUCATION OF BALANCE WITH OR WITHOUT VISUAL AFFERENT
- cortex involved in voluntary movement – CLOSED KINETIC CHAIN OR MAINTENANCE OF FINAL POSITIONS (<http://www.scribd.com/doc/227803314/Prezentare-Pitesti-Ro#scribd>)

Advantages of proprioceptive exercises:

- Integrated movement for very precise specialization of the exercise for a segment of a limb (even distal), muscle contractions obtained, whether

phasic or tonic, are never separated from the normal appearance.

In fact, there are two possibilities:

- the contractions are the starting point in overall reaction, and the reactions associated with this movement occurs normally and even strengthen the first ones;
- the contractions are obtained by full activation of muscles to which they belong.

A very interesting fact is that athletes subject to this type of exercise do not realize (or they slightly do it) all activities performed, even if they concern very cortical muscle groups.

Disadvantages of this type of exercises:

- The difficulties of application are mainly related on choosing the most effective exercise, depending on its educational usefulness and lower number of local and general risks.
- Another aspect that raises problems is therapeutic technique: so it is good for the therapist to exercise control during the whole exercise and to always take the opportunity to intervene, by limiting the reactions when they become sufficient or reach a level at which local and general risks are too high.

- This brings us to the question of dosage, which can only be determined in figures with great difficulty (<http://www.mediculmeu.com/boli-si-tratamente/kinetoterapie/exercitii-terapeutice-de-reprogramare-neuromotorie-exercitii-proprioceptive.php>)

Proprioception assessment is achieved by:

- Establishing the functional condition of proprioceptive and kinetic sensitivity – the method of positioning and passive movement; praxis method;
- Assessing the balance;
- Measuring the passive motion threshold (kinesthesia), assessing the direction by active movements.
- Isokinetic equipment, goniometers, image acquisition and motion analysis systems.

The role of these exercises is greatest in developing not only biomechanical indices specific to certain movements of ankle and knee joints, but also in developing parameters specific to coordination and static and dynamic balance, which are related to various sports (<http://www.scribd.com/doc/227803314/Prezentare-Pitesti-Ro#scribd>)

The frequency with which have practiced these drills is twice a week for 15 minutes, as Olsen,



O.E., Myklebust, G., et al., 2005, Waldén, M., Atroshi I., et al. 2012 argue.

### Discussion

As pointed above, a number of authors believe that the women that include in their preparation also the proprioception exercises will benefit in terms of strength and neuromuscular control, dynamic stability and growth of the joints (the joints stability during movement) and relearning pattern of movements and skills used during the performance of daily activities and those that are specific to the sport practised (Myer, et al., 2005; Zouita et al., 2009).

Other authors have concluded that proprioceptive training must be carried out by all the athletes who practice a sport characterized by a large number of jumps and changes of direction, in which the proportion of sprains and knee to the ankle is great and where physical fatigue occurs significantly. Hägglund, Waldén, Atroshi, 2009, said that proprioceptive training considers "these exercises help to improve rapid changes of direction and of muscle force and have a beneficial effect in recovery after trauma to the knee".

The conclusions of other studies-Gustavsson, et al., 2006, Coughlan, Caulfield, 2007 - believes that a single leg exercises, on unstable surfaces- Bossu balls-lead to improvements of proprioception, improvements of dynamic stability of knee joint by developing the muscles around the joints.

In terms of frequency of this type of practicing exercises, Chappell, Limpisvasti, 2008, consider "a program of proprioceptive training for 6 weeks improves significantly the results of the jumping and is effective in preventing accidents in athletes". Also, Olsen, Myklebust, et al., 2005; Waldén, Atroshi, et al., 2012, showed that "a proprioceptive training program conducted by 15 minutes twice a week reduces the rate of occurrence of accidents at knee level with 64%".

### Conclusions

1. The proprioceptive training are effective in improving and recovering proprioception and also in increasing muscular strength and power.

2. The main aim of the proprioceptive exercises is to re-educate proprioceptive reflexes in order to obtain a ' control ' over the muscles optimally and movements

3. As preventive role, proprioceptive exercises are carried out with the aim to achieve a faster and better control the muscles.

4. This type of workout is essential to a full recovery after an injury (to restore the reflexes and reactivate all the information channels interrupted by accident); in preventing injuries (to have a faster muscle control during game action and to encourage whole groups requiring muscle contractions, avoiding isolated contraction); to develop a sense of balance and control of movements.

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