

# ECCENTRIC POWER AND RETURN TO SPORT AFTER ACL RECONSTRUCTION

Zuppardo.S <sup>1</sup>, Ferrari E. <sup>1</sup>, Merlo F <sup>2</sup>.

<sup>1</sup>Pegaso Medical Center Grosseto Italy - <sup>2</sup>Performance Medical Center Siena Italy

## Introduction

This study tried to assess the eccentric strength deficit during the last rehabilitation phase after ACL reconstruction and the recovery of such deficit after resuming agonistic sport activity. As a matter of fact, many studies have lately focused their attention on the recovery of the eccentric strength by means of rehabilitation protocols with early high intensity resistance exercises stimulating the eccentric phase(1) (3).

## Materials And Methods:

The study examined 15 amateurish footballers, who had all undergone ACL reconstruction carried out by the same surgeon (6 BPTB and 9 STx4) and aged between 14 and 48 years (average age 25.1±9.1 yrs).

Rehabilitation was effected in the same Medical Centre with the same therapists and using the same protocol. Patients were divided into two groups: the first one (8 individuals) had undergone reconstruction 4-8 months earlier without resuming any sport activity.

The second group (7 individuals) had undergone reconstruction 12-24 months earlier and had all resumed their previous level sport activity 12.8±7.1 months after surgery. The group did not do any specific eccentric rehabilitation with the flywheel isoinertial device. The test consisted in only one set of 10 one leg squats (0° - 80°) first on the uninvolved and then on the involved limb.

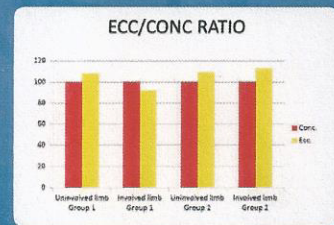
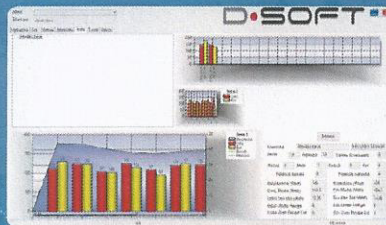
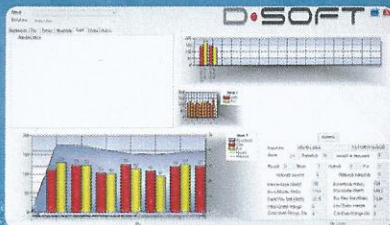
The evaluation Desmotec D11 Fiso isoinertial device has a hip belt connected with a set of strings which are rolled around the central axis at the end of which a Flying Wheel is fit. A horizontal bar in front of the device allows patients to keep their balance during the test, while a telescopic bar at the back of the device helps to adjust the knee flexion angle.

During the concentric phase, by pulling the strings, the Flying Wheel starts rotating. At the end of this phase, the strings will be totally loose but, because of the accumulated inertia, the device will go on rotating, this time rolling the strings contrariwise and starting the eccentric phase by pulling the patient downwards with the same kinetic energy stored during the concentric phase. Such energy will be proportional to the rotating speed, the diameter and the Flying Wheel mass. An encoder, set on the rotation axis, sends the data to D.Soft USB software which can assess the concentric-eccentric power peak of every repetition and the peak average in Watts.

Moreover, we calculated the eccentric/concentric strength ratio which, according to literature, should be >1 (1.10-1.15).



**Results :** Values obtained at the end of the tests showed that all the individuals of the first group had both a concentric and eccentric strength deficit of the involved limb and that such deficit could be observed both in the peak and in the average. However, while in the involved limb the concentric deficit showed median values of 19% (22% on the peak averages), the eccentric strength values increased to 32% (29% on the peak averages). The eccentric/concentric ratio seemed almost normal in the uninvolved limb.



**Conclusions :** On the basis of such data, although the number of individuals examined was relatively small, we can infer that a high percentage of amateurish athletes probably resume their agonistic sport activity with a significant eccentric strength deficit which will be recovered gradually during (and by means) of the agonistic activity.

During such phase, the risk of getting injured again is obviously higher. Rehabilitation protocols should include eccentric training (also using a flywheel isoinertial device) even during the first post surgical phase as many studies have shown that such training is safe (2). We suppose that the eccentric training may help the recovery of the eccentric/concentric ratio before restarting a full agonistic activity.

	Uninvolved limb			Involved limb		
	Eccentric	Concentric	Ratio Ecc/conc	Eccentric	Concentric	Ratio Ecc/conc
4-8 months after ACLR	343±285	330±288	1.08±0.18	286±252	319±294	0.92±0.11
12-24 months after ACLR	395±167	366±159	1.09±0.11	435±203	412±246	1.13 ±0.23

## References:

- Lorenz D, Reimann M. The role and implementation of eccentric training in athletic rehabilitation: tendinopathy, hamstring strain and ACL reconstruction. Int J Sports Phys Ther 2011; 6: 27-44
- Gerber JP, Marcus RL, Dibble LE, Greis PE, Burks RT, LaStayo PC. Effects of early progressive eccentric exercise on muscle size and function after anterior cruciate ligament reconstruction: a 1-year follow-up study of a randomized clinical trial. Phys Ther 2009; 89: 51-59
- Lepley LR, Palmieri-Smith R. Effect of Eccentric strengthening, following anterior cruciate ligament reconstruction on quadriceps strength. J Sports Rehab 2013; 22: 150-156



## ECCENTRIC POWER AND RETURN TO PLAY AFTER ACL RECONSTRUCTION



Zuppardo S<sup>1</sup>, Ferrari E<sup>1</sup>, Merlo F<sup>2</sup>

<sup>1</sup>Pegaso Medical Center Grosseto;

<sup>2</sup>Performance Medical Center, Siena, Italy

### Introduction

This study tried to assess the eccentric strength deficit during the last rehabilitation phase after Anterior Cruciate Ligament (ACL) reconstruction and the recovery of such deficit after return to competitions.

As a matter of fact, many studies have lately focused their attention on the recovery of the eccentric power by means of rehabilitation protocols with early high intensity resistance exercises performed also with eccentric actions (2, 3).

### Methods

We examined 15 amateur football players aged between 14 and 48 years (average age  $25.1 \pm 9.1$  yrs), after ACL reconstruction (6 Bone-Patellar-Tendon-Bone, and 9 Semitendinosus-Gracilis x 4) carried out by the same surgeon.

Rehabilitation was carried out in the same Medical Centre with the same therapists and using the same protocol.

Patients were divided into two groups: the first one (N=9) had undergone reconstruction 4-8 months earlier, and are still involved in the rehabilitation process.

The second group (N=6) underwent the ACL reconstruction 12-24 months earlier and all the players return to competitions at the same level of sport activity  $12.8 \pm 7.1$  months after surgery. This group did not do any specific eccentric strengthening with the flywheel isoinertial device.

Both groups were tested for eccentric and concentric power with an isoinertial device (D11 Fisio; Desmotec, Biella, Italy). The test consisted in only one set of 10 one-leg-squats (knee range of motion:  $0^\circ$ - $80^\circ$ ), at first performed by the uninvolved and then on the involved limb.

The evaluation device has a hip belt connected with a set of strings which are rolled around the central axis at the end of which a flying wheel is fit. A horizontal bar in front of the device allows players to keep their balance during the test, while a telescopic bar at the back of the device helps to adjust the knee flexion angle.

During the concentric phase, by pulling the strings, the flying wheel starts rotating. At the end of this phase, the strings will be totally loose but, because of the accumulated inertia, the device will go on rotating, this time rolling the strings contrariwise and starting the eccentric phase by pulling the patient downwards with the same kinetic energy stored during the concentric phase. Such energy will be proportional to the rotating speed, the diameter and the flying wheel mass. An encoder, set on the rotation axis, sends the data to D.Soft USB software, which can assess the concentric-eccentric power peak of every repetition and the peak average power.

Moreover, we calculated the eccentric/concentric ratio which, according to literature, should be  $>1$  (range 1.10-1.15).