



ELSEVIER

Contents lists available at ScienceDirect

## Human Movement Science

journal homepage: [www.elsevier.com/locate/humov](http://www.elsevier.com/locate/humov)



# Muscle strength and functional performance is markedly impaired at the recommended time point for sport return after anterior cruciate ligament reconstruction in recreational athletes



CrossMark

Jesper Bie Larsen<sup>a,c,\*</sup>, Jean Farup<sup>a</sup>, Martin Lind<sup>b</sup>, Ulrik Dalgas<sup>a</sup>

<sup>a</sup> Dep. Public Health, Section of Sport Science, Aarhus University, Dalgas Avenue 4, 8000 Aarhus C, Denmark

<sup>b</sup> Department of Orthopedics, Aarhus University Hospital, Tage Hansensgade 2, 8000 Aarhus C, Denmark

<sup>c</sup> University College of Northern Denmark, Selma Lagerlöfs Vej 2, 9220 Aalborg Øst, Denmark

### ARTICLE INFO

#### Article history:

Available online 24 November 2014

#### PsycINFO classification:

2220  
2221  
2330  
3720

#### Keywords:

Eccentric  
Isometric and concentric muscle strength  
Rate of force development  
Control group

### ABSTRACT

**Purpose:** To examine potential deficits in muscle strength or functional capacity when comparing (1) an ACL reconstructed group to matched healthy controls, (2) the ACL reconstructed leg to the non-injured leg and (3) the non-injured leg to matched healthy controls, at the time-point of recommended sport return 9–12 months post-surgery.

**Methods:** Sixteen patients (male-female ratio: 9:7) 9–12 months post ACL reconstruction and sixteen age and sex matched healthy controls were included. Outcome measures included maximal knee extensor (KE) and knee flexor (KF) dynamometry, including measurement of rate of force development, functional capacity (counter movement jump (CMJ) and single distance hop (SDH)) and the Lysholm score.

**Results:** Compared to the control group, maximal KE and KF muscle strength were impaired in the ACL reconstructed leg by 27–39% and 16–35%, respectively ( $p < .001$ ). Also, impairments of both CMJ (38%) and SDH (33%) were observed ( $p < .001$ ). Rate of force development for KE were reduced in the ACL group compared to the control group ( $p < .001$ ). Similarly, the KE and KF muscle strength, CMJ and SDH of the ACL reconstructed leg were impaired, when compared to the non-injured leg by 15–23%, 8–20%, 23% and 20%, respectively ( $p < .05$ ).

\* Corresponding author at: Dep. Public Health, Section of Sport Science, Aarhus University, Dalgas Avenue 4, 8000 Aarhus C, Denmark. Tel.: +45 28 26 84 59.

E-mail address: [jesperbielarsen@gmail.com](mailto:jesperbielarsen@gmail.com) (J.B. Larsen).

*Conclusion:* Muscle strength and functional capacity are markedly impaired in the ACL reconstructed leg of recreationally active people 9–12 months post-surgery when compared to healthy matched controls and to their non-injured leg. This suggests that objective criteria rather than “time-since-surgery” criteria should guide return to sport.

© 2014 Elsevier B.V. All rights reserved.

## 1. Introduction

Anterior cruciate ligament (ACL) injury occurs frequently and the incidence of ACL reconstruction is 38 pr. 100.000 citizens in Denmark (Lind, Menhert, & Pedersen, 2009). Typically, ACL injuries occur during sports activities, such as soccer, handball or alpine skiing, and usually the injured person wishes to return to sports activities after the ACL reconstruction (Granán, Forssblad, Lind, & Engebretsen, 2009; Lind et al., 2009). There are no evidence based guidelines describing when to return to sport after ACL reconstruction, although a time-point 9–12 months post-surgery is usually recommended before returning to contact sports (Ardern, Webster, Taylor, & Feller, 2011; Gobbi & Francisco, 2006; Thomee et al., 2011). However, a narrow fixed timeframe may not allow for individual variation, nor give any quantitative evaluation establishing, whether the ACL reconstructed knee is ready to reenter sports activity. It has, therefore, been suggested, that muscle strength and functional capacity of the ACL reconstructed leg is “normal” and ready for sports return, when corresponding to 90% of the non-injured leg (Risberg, Holm, & Ekeland, 1995; Thomee et al., 2011).

In the literature there is a vast amount of studies comparing muscle function and functional capacity of the ACL reconstructed leg to the non-injured leg at different time-points after ACL reconstruction. At 9–12 months after ACL reconstruction studies have shown knee extensor (KE) (Burks, Crim, Fink, Boylan, & Greis, 2005; de Jong, van Caspel, van Haeff, & Saris, 2007; Kobayashi et al., 2004; Palmieri-Smith, Thomas, & Wojtys, 2008; Yosmaoglu, Baltaci, Kaya, & Ozer, 2011) and knee flexor (KF) (Burks et al., 2005; de Jong et al., 2007; Kobayashi et al., 2004; Yosmaoglu et al., 2011) muscle strength deficits of 5–27% and +1–21%, respectively, when comparing the ACL reconstructed leg to the non-injured leg. Generally subjects with a Bone Patellar Tendon Bone (BPTB) graft exhibits a larger deficit in KE muscle strength, whereas subjects with a semitendinosus-gracilis (STG) reveals larger deficits in KF muscle strength (Thomee et al., 2011). Also, functional capacity, in terms of one-legged hop tests such as Counter Movement Jump (CMJ) and Single Hop for Distance (SHD), have shown deficits varying from 5–11%, when compared to the non-injured leg 9–12 months post ACL reconstruction (Augustsson, Thomee, & Karlsson, 2004; de Jong et al., 2007; Hopper et al., 2002; Yosmaoglu et al., 2011). It appears that some studies exhibit LSI scores within the acceptable range of >90% and others reveal larger deficits at the time of recommended return to sport. These results could be biased because the non-injured leg, which is used as reference, seems to be influenced by the change in activity level that occurs when injured. Several authors have reported that a unilateral ACL injury results in bilateral muscle strength deficits, making the non-injured leg sub-optimal as a “healthy” reference (Hiemstra, Webber, MacDonald, & Kriellaars, 2000, 2007; Krishnan & Williams, 2011; Palmieri-Smith et al., 2008; Urbach, Nebelung, Becker, & Awiszus, 2001). Several studies exhibit somewhat larger deficit in the range of 16–27% when comparing the ACL reconstructed leg to a healthy control group (Hiemstra et al., 2000, 2007; Mattacola et al., 2002; Xergia, Pappas, Zampeli, Georgiou, & Georgoulis, 2013). Yet, none of the existing studies made their examination within the timeframe for recommended return to sports and therefore, it is unknown to what degree deficits exists regarding muscle strength and functional capacity at this timeframe. Hence, knowledge is warranted in order to evaluate if the timeframe 9–12 months is appropriate or to promote the need for objective measurements to evaluate readiness for return to sport. Another important aspect of muscle function is the rate of force development (RFD), which quantifies the ability to rapidly generate muscle force.

Download English Version:

<https://daneshyari.com/en/article/928290>

Download Persian Version:

<https://daneshyari.com/article/928290>

[Daneshyari.com](https://daneshyari.com)