Physical Therapy in Sport 10 (2009) 75–80

Contents lists available at ScienceDirect

Physical Therapy in Sport

journal homepage: www.elsevier.com/ptsp

Case study

Application of eccentric exercise on an Australian Rules football player with recurrent hamstring injuries

Matt Brughelli [a,*], Ken Nosaka [a], John Cronin [a,b]

[a] School of Exercise, Biomedical and Health Sciences, Edith Cowan University, 100 Joondalup Drive, Joondalup, Western Australia 6027, Australia
[b] Institute of Sport and Recreation Research New Zealand, AUT University, Private Bag 92006, Auckland 1020, New Zealand

ARTICLE INFO

Article history:
Received 22 September 2008
Received in revised form
27 November 2008
Accepted 4 December 2008

Keywords:
Muscle strain
Isokinetic
Rehabilitation
Knee flexion

ABSTRACT

Study Design: Case report.

Objective: To assess an eccentric based intervention on an Australian Football player with recurrent hamstring injuries.

Case description: The athlete attempted several conventional rehabilitation programs in the past (e.g. physical therapy, manual therapy, acupuncture, active release, medial gluteal strengthening) with no sustained progress in regards to pain, soreness, or return to sport.

Outcomes: After the first three phases of the intervention (i.e. nine weeks), the optimum angle of peak torque during knee flexion decreased from 37.3 to 23.9 degrees in the injured leg, and from 24.3 to 20.3 degrees in the non-injured leg. After the first nine weeks, the optimum angles then remained constant for another 23 weeks. The optimum angle of peak torque was also shifted in the knee extensors by 3.9 degrees (injured leg) and 3.4 degrees (non-injured leg) after nine weeks and then remained constant for the remaining 23 weeks. Quadriceps to hamstring peak torque ratio's (Q/H ratios) and peak torque during knee flexion and extension remained constant throughout the intervention.

Discussion: An eccentric based intervention was shown to be safe and effective for altering the optimum angle of peak torque (i.e. shifting to longer muscle lengths) for this athlete with recurrent hamstring injuries.

1. Introduction

Hamstring muscle strain injuries are common in sports that require maximum effort sprinting and acceleration. It has been reported that hamstring injuries alone account for 16–29% of all injuries reported in soccer (Árnason, Sigurdsson, Gudmundsson, Home, Engebretsen, & Bahr, 2004; Crosier, 2004), Australian Rules football (Orchard & Seward, 2002) and rugby union (Brooks, Fuller, Kemp, & Reddin, 2005; Brooks, Fuller, Kemp, & Reddin, 2006). Furthermore, a significant amount of playing and practice time is lost after a hamstring injury (18 days on average) (Woods, Hawkins, & Maltby, 2004) and the risk of re-injury is very high (Orchard & Seward, 2002).

Skeletal muscles have an optimum length for producing peak tension. Muscle strain injuries are thought to occur when activated muscles are lengthened to greater than optimal lengths (Friden & Lieber, 2001). The hamstring muscles are actively lengthened during hip flexion and knee extension, which occur simultaneously during the late swing phase in running (i.e. as the air-borne leg swings forwards). It has been argued that hamstring injuries can be reduced if this optimum length can be increased through training (Brockett, Morgan, & Proske, 2001; Brockett, Morgan, & Proske, 2004). The only form of training that has been shown to consistently increase the optimum length of tension development has been eccentric exercise (Bowers, Morgan, & Proske, 2004; Brockett et al., 2001; Kilgallon et al., 2007; Pettitt, Symons, Eisenman, Taylor, & White, 2005; Philippou, Bogdanis, Nevill, & Maridaki, 2004; Yeung & Yeung, 2008). The purpose of this case report was to examine the effects of an eight month eccentric exercise/rehabilitation program on the optimum length of tension development on an athlete with recurrent hamstring injuries to his right leg.

2. Case description

A 24-year-old male Australian Rules football player (weight 86.6 kg, height 187 cm) presented for athletic and lower-body physiological testing. The athlete played on the senior squad of a West Australian Football League team for the previous three years.

* Corresponding author. Tel.: +1 61 86304 5152; fax: +1 61 86304 5036.
E-mail address: m.brughelli@ecu.edu.au (M. Brughelli).

1466-853X/$ – see front matter © 2008 Elsevier Ltd. All rights reserved.
doi:10.1016/j.ptsp.2008.12.001

Table 1
Eccentric strength intervention.

Phase 1 (Week 1)	Phase 2 (Weeks 2–5)	Phase 3 (Weeks 6–9)
Monday	*Tuesday*	*Tuesday*
Eccentric Box Drops	Box Lunge Drops	Eccentric Resisted Pushes
6 sets of 10 drops	5 sets of 10 drops	4 sets of 20 steps
(12 inches)	(12 inches)	(10 steps each leg)
Wednesday	*Thursday*	*Thursday*
Eccentric Box Drops	Eccentric Towel Pulls	Weighted Drop Lunges
6 sets of 10 drops	4 sets of 20 steps	(4 sets of 8 drops)
(18 inches)	(10 steps each leg)	
Friday		
Eccentric Box Drops		
6 sets of 10 drops		
(24 inches)		

His past medical history included three muscle strain injuries confirmed by MRI (grade II and III muscle strain injuries) to his right hamstring (long head of the biceps femoris) over the previous four years. The most recent and severe hamstring injury occurred 16 months prior to the present testing. Since the injury occurred, he has missed several games and practices, and has attempted several rehabilitation programs (e.g. physical therapy, manual therapy, acupuncture, active release, medial gluteal strengthening) with no sustained progress in regards to pain, soreness, or return to sport.

Fig. 1. Starting position for eccentric box drops. The athlete stepped up onto a box and then stepped off the box. Upon landing the athlete bent down into a parallel squat position.

2.1. Tests and measures

A Biodex 3.0 isokinetic dynamometer (Shirley, NY, USA) was used to measure peak torque (muscle force × moment arm) values, peak torque ratios between the quadriceps and hamstrings (Q/H ratios), and torque-angle curves during knee flexion and knee extension (both legs). The "zero angle" was set at full leg extension during both knee flexion and extension. The athlete performed six maximum-effort concentric knee flexions and knee extensions. The average of the six contractions was used as the final value. The angular velocity of knee flexion and extension was set at 60 degrees per second. The optimum angle of torque development (the knee angle were peak torque was produced) was determined with a quadratic polynomial fitting curve. Peak torque (N-m) was determined from the peak of the curve. The positioning and setting of the dynamometer were consistent amongst the measures and all measurements were conducted by the same tester. The Biodex 3.0 isokinetic dynamometer has proven to be mechanically valid and reliable in regards to torque, velocity and position (Drouin, Valovich-mcLeod, Shultz, Gansneder, & Perrin, 2004). Q/H ratios were calculated as the ratio of peak torque during knee extension (quadriceps femoris) and knee flexion (hamstrings). In the present study, the within-trial coefficients of variations (CV) for all mean values (i.e. peak torque, Q/H ratios and optimum angles) were less than 7.0%.

2.2. Intervention

The athlete was placed on a rehabilitation program that involved functional eccentric exercises, light-to-moderate graded running and upper-body resistance training. The eccentric exercise

Fig. 2. Ending position for eccentric box drops. The athlete stepped up onto a box and then stepped off the box. Upon landing the athlete bent down into a parallel squat position.