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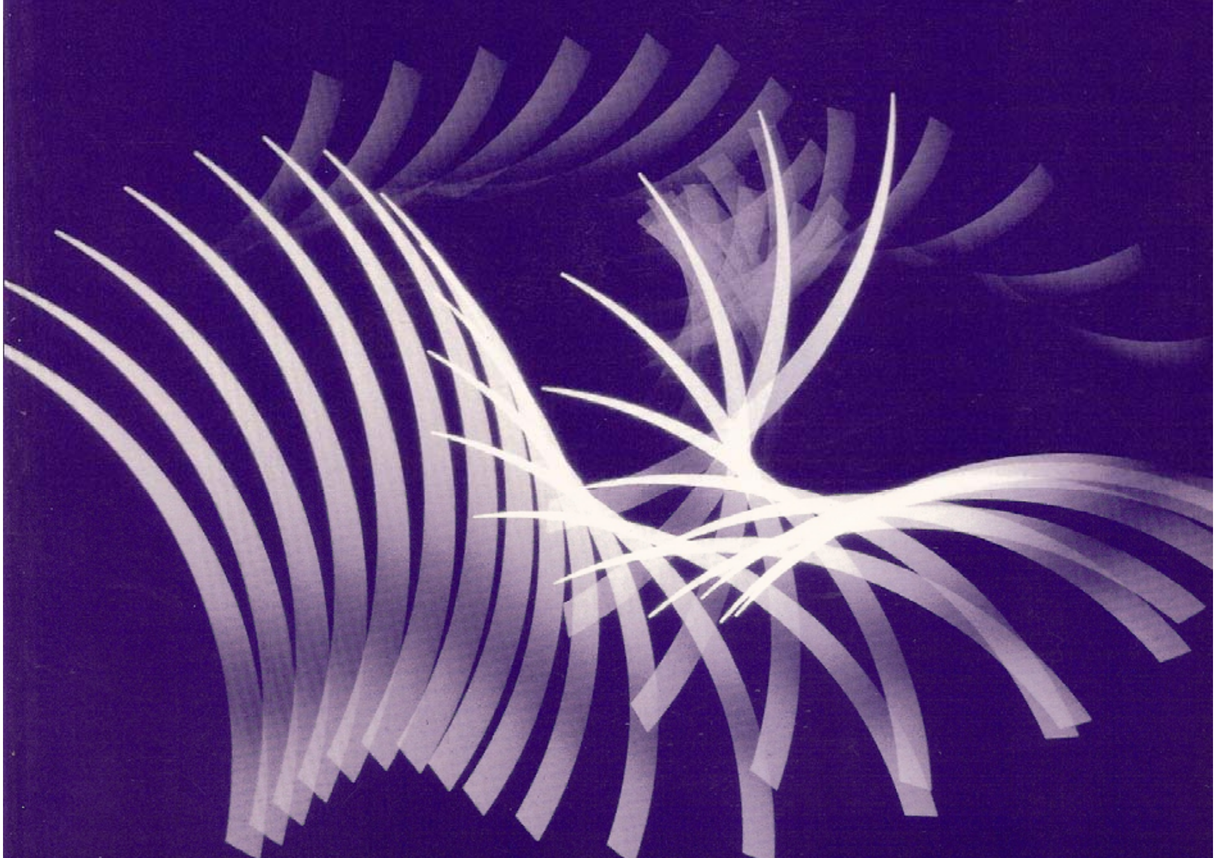

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Table 1
Indicators for reproducibility (example of left knee joint measurements)

Work mode		Nr- value	TRV [%]	LOA: Bias ± random error	LOA: Bias ± random error	crep	
Eccentric	Extension	25	0.88	11.16	-2.56 ± 53.5	$0.97 \times/\div 1.32$	0.95
	Flexion	25	0.85	9.62	0.08 ± 34.1	$1.00 \times/\div 1.27$	0.95
Concentric	Extension	26	0.89	11.60	0.00 ± 38.19	$1.00\times/\div 1.33$	0.96
	Flexion	26	0.89	8.48	-2.31 ± 23.40	$0.98 \times/\div 1.22$	0.95

References

[1] G. Atkinson and A.M. Nevill, *Sports Med* **26** (1998), 217–238.
[2] J.M. Bland and D.G. Altman, *Lancet* (1986), 307–310.
[3] F. Mayer, T. Horstmann, K. Kranenberg, K. Röcker and H.H. Dickhuth, *Int J Sportsmed* **15** (1994), 26–31.

Evaluation of plyometric exercise training on functional performances and isokinetic strength

C. Lehance[a,*], J-L. Croisier[b], D. Maquet[b] and T. Bury[a]
[a]*Department of Physiology of Sports, University of Liège, Belgium*
[b]*Department of Physical Medicine and Rehabilitation, University Hospital Center, Liège, Belgium*

Introduction: Plyometric or stretch-shortening cycle exercises evoke the elastic properties of the muscle fibers and connective tissue, allowing muscle to store energy during the deceleration phase and then releasing energy during the acceleration period. The end result is that muscles are trained under tensions greater than those achieved by conventional slow-speed resistance training. The purpose of this study was to evaluate the plyometric training effects on isokinetic and functional performances.

Methods: Twenty sedentary subjects were randomly assigned to 2 groups: either a plyometric training group (PT; $n = 10$) or a control group (CG; $n = 10$). The isokinetic strength of knee extensor and flexor muscles was measured in the eccentric mode (30°.sec^{-1} and 120°.sec^{-1}) and through concentric exertions (60°.sec^{-1} and 240°.sec^{-1}). Vertical jump (one leg and two legs) and 10 m sprint time were measured by Optojump system. Functional performances, mechanical power and maximal leg strength were measured before and after six weeks of plyometric training. PT performed plyometric training, in the form of dynamic depth jumps, two times per week for 6 weeks.

Results: After six weeks, the plyometric training significantly improved ($p < 0.05$) the functional tests results (drop jump: +27.9%; counter movement jump: +19.7%; counter movement jump free arms: +19%; drop jump dominant leg: +15.6%). We observed a trend toward an increase (no significant) of the knee flexor and extensor isokinetic strength in concentric (60°.sec^{-1} and 240°.sec^{-1} for both flexor and extensor muscles) and eccentric (30°.sec^{-1} and 120°.sec^{-1} for flexors) (Fig. 1). Only flexors in eccentric at 120°.sec^{-1} showed significant ($p < 0.05$) increase (+13.4%).

Discussion: Our results showed that a plyometric training significantly improve vertical jump height (one leg and two legs) compared to control group. This observation can be attributed to neuromuscular adaptations and to a rise in positive energy production. The eccentric isokinetic strength and power of leg flexors at high velocity (120 °.sec^{-1}) improved significantly after training. This finding is relevant because hamstring muscle strains are common injuries in sports with high demands on speed and power, such as soccer. Strength training has been advocated as a preventive measure in order to avoid hamstring muscle injuries [1]. Increasing amounts of evidence point to the advantages of

*Address for correspondence: Cédric Lehance, Institut Supérieur d'Education Physique et de Kinésithérapie, B21, Allée des Sports 4, B-4000 Liège, Belgium. E-mail: clehance@ulg.ac.be

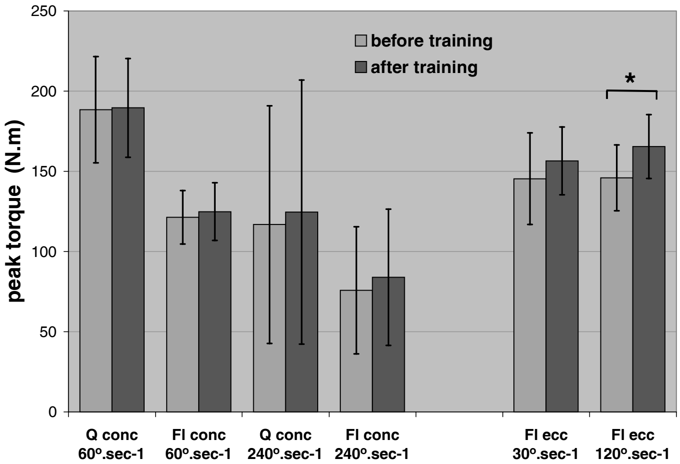

Fig. 1. Knee flexor and extensor isokinetic strength after plyometric training (*$p < 0.05$).

including eccentric muscle actions in strength training regime to achieve optimal effects. This has been demonstrated both in studies of changes in maximal strength performance and in rehabilitation studies [2].

Conclusion: In a sedentary group, plyometric training improves functional abilities (especially vertical jump), eccentric strength and power of leg flexors at high velocity. It would be fit to conduct the same experimentation in sports with high demands on speed and power. One can suggest that plyometric training would be beneficial both for injury prevention and for field performance enhancement.

References

[1] J.-L. Croisier, *Am J Sports Med* **30**(2) (2002), S199–S203.

[2] C. Askling, *Scand J Med Sci Sports* **13** (2003), S244–S250.

Effects of orthotic insoles on biomechanical gait characteristics in healthy children

S. Müller*, H. Baur, A. Hirschmüller and F. Mayer

Medical Clinic, Department of Sports Medicine, University of Freiburg, Hugstetterstr. asse. 55, 79106 Freiburg, Germany

E-mail: mueller@msm1.ukl.uni-freiburg.de

Introduction: The incidence of treatments of children's feet with orthotic insoles is discussed controversially. An excessive number of children are treated under preventive aspects with these devices [2]. The effect on the neuromuscular system in healthy children is still unclear. The purpose of the study was to investigate the effect of orthotic insoles on neuromuscular activity in healthy children.

Methods: 234 children, without foot related complains, were analyzed once while walking on a treadmill ergometer (HP COSMOS®, Quasar) (Table 1). Bipolar surface electromyography (sample frequency 500 Hz) was measured on 3 lower leg muscles (M. tibialis anterior, M. peroneus longus, M. gastrocnemius medialis). Subjects walked barefoot (a), with an reference shoe (b) and with three different insoles (c: neutral flexible insole; d: rigid leather insole with brace and longitudinal wedge; e: flexible insole with longitudinal and detorsion wedge) at an age-based speed (2; 3.5; 5 km/h) in random order. EMG amplitude quantities in weight acceptance (A_{wa}) and mid stance

*Corresponding author.