Sagittal joint moment distribution across lower limb joints during multidirectional unilateral landings tasks

Inaê de Oliveira[1,2], Luiza Rossdeutscher[1], Thaline Turquette[1], Felipe P Carpes[1,2]
[1] Applied Neuromechanics Research Group, Federal University of Pampa, Uruguaiana, RS, Brazil
[2] Programa de Pós-Graduação Multicêntrico em Ciências Fisiológicas, Federal University of Pampa, Uruguaiana, RS, Brazil
Email: inaeoliveira.aluno@unipampa.edu.br

Summary

This study examined the distribution of joint moments in the lower limbs during the landing phase of unilateral jumps performed in different directions. Participants executed unilateral jumps in lateral, diagonal, and forward directions to evaluate the distribution of joint moments during landing. Our findings revealed no significant effects of leg or jump direction on joint moment contributions. However, a main effect of the joint was observed, with the ankle and hip exhibiting approximately a 10% difference in contribution.

Introduction

Multidirectional jumping is a movement pattern presented in various sports. Given the high mechanical demands imposed on the lower limbs during landing, the biomechanical strategies adopted in multidirectional jumps may help to understand how movement technique influence the presence of risk factors for injury. The contribution of different lower limb joints to impact absorption is key aspect for and enhanced landing mechanics [1]. The ankle, knee, and hip play distinct roles in distributing the forces experienced during landing, and alterations in their contributions may influence injury risk [2]. Therefore, investigating how joint contributions vary across different jump directions can provide valuable insights for injury prevention strategies and rehabilitation programs tailored to multidirectional sports.

Methods

In this preliminary research, 10 physically active participants (8 men and 2 women, mean ± standard deviation age 22.7 ± 2.6 years, body mass 73.3 ± 9.6 kg and height 1.73 ± 0.6 cm) with no history of injuries were recruited. They underwent kinetic (OR6-2000, AMTI Inc., USA; 1 kHz) and kinematic (Vicon Motion Systems, 15 cameras B10, 200 Hz) assessments of unilateral multidirectional jumps (90º lateral, 45º diagonal, and forward), for both legs. They jumped 70 cm from the force plate , as high as possible. Sagittal joint moments were determined for the ankle, knee, and hip and averaged during the landing phase, considering 3 trials for each leg and direction. To estimate the joint contribution the total support moment was analyzed [3]. Repeated measures ANOVA determined the effects of leg, jump direction, and joint on the distribution of joint moments with an alfa of 5%.

Results and Discussion

No main effects were found for leg (F=0.0, p = 1.0) or jump direction (F=0.0, p=1.0) on the individual joint contribution to the total support moment. A main effect for joint (F = 5.1, p = 0.007) indicated mean differences of approximately 10% in contribution between the ankle and hip (p=0.004).

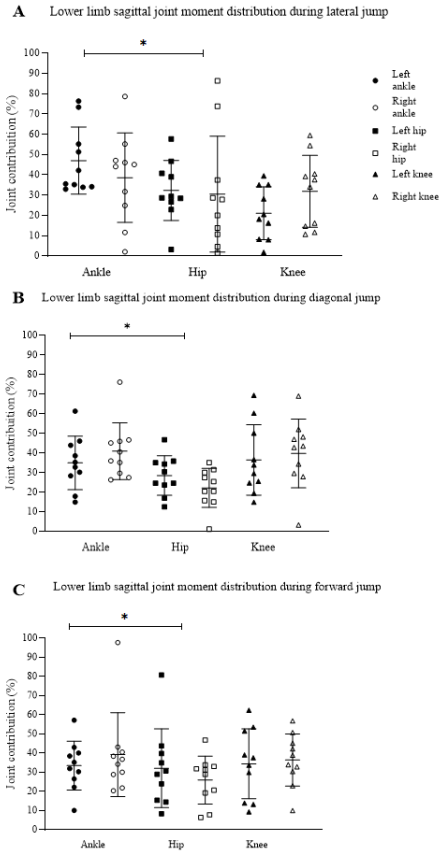

Figure 1: Joint moment distribution across legs and landings.

Conclusions

The landing direction did not influence the sagittal joint moment distribution across the lower limb joints during unilateral landings.

Acknowledgments

Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES).

References

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