A KINEMATIC AND KINETIC COMPARISON OF THE COUNTER MOVEMENT JUMJ AND STOP JUMP RECEPTIONS

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Introduction

Repetitive jumps, changes of direction and running may contribute to increase the risk of overuse injury in sports such as volleyball and basketball. Concerning tendinopathies, epidemiological studies have shown higher rates of patellar tendinopathies than Achilles tendinopathies [1]. Even if the practice of volleyball and basketball implies both vertical and horizontal jumps, no comparison between both jumps have been performed despite possible different implication on injury risk. The objective of this study was therefore to compare a vertical jump (counter movement jump – CMJ) and a horizontal jump (stop jump – SJ).

Methods

Thirty-four volleyball and basketball players (22.1±2.7 years old, 80.2±8.9 kg, 1.86±0.07m) were evaluated for CMJ and SJ receptions. After warm-up and familiarization, the volunteers performed 5 CMJs and 5 SJs. The SJ consists in a horizontal run-up followed by a one-foot horizontal impulsion and finally a bipodal vertical impulsion to perform a maximal vertical jump (Figure 1). In order to evaluate the reproducibility of the tests, the volunteers performed the same session again one week later.

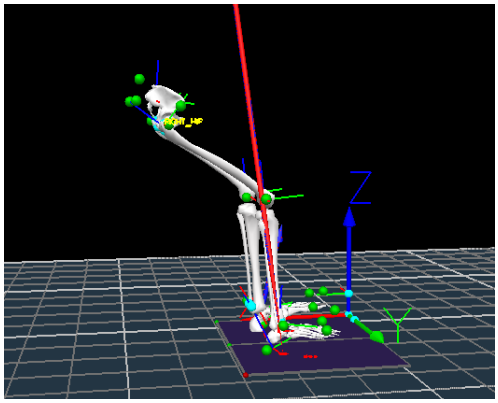

Figure 1: Stop jump bipodal reception before vertical jump.

In this study the bipodal horizontal reception of the SJ was compared to the bipodal vertical reception of the CMJ. 3D markers were placed on the lower limbs (Codamotion, Charwood Dynamics) and receptions were performed on force plates (Kistler). Kinematic (ankle and knee angles in the sagittal plane) and kinetic (ankle and knee moments in the sagittal plane as well as the vertical and antero-posterior ground reaction forces) were computed using Visual3D software (C-motion). To evaluate the reproducibility of the evaluations, intra-class correlations – ICC (A, 1) – were computed as well as paired sample T-tests. To compare the receptions of the two types of jumps, paired sample T-tests were performed on the values measured during the 1st session.

Results

CMJ and SJ present poor to good reliability depending on the parameters studied (Table 1).

		ICC	p
CMJ	Ankle A (°)	0.62	0.86
	Ankle M (N.m/kg)	0.51	0.11
	Knee A (°)	0.8	0.004
	Knee M (N.m/kg)	0.21	0.71
	Vert GRF (BW)	0.34	0.28
	Ant GRF (BW)	0.58	0.2
SJ	Ankle A (°)	0.62	0.04
	Ankle M (N.m/kg)	0.83	0.21
	Knee A (°)	0.88	0.57
	Knee M (N.m/kg)	0.18	0.62
	Vert GRF (BW)	0.52	0.67
	Ant GRF (BW)	0.58	0.45

Table 1: Parameters' reproducibility. A stand for angle, M for moment and GRF for ground reaction forces.

The comparison of CMJ and SJ shows significantly different kinematics with less ankle dorsiflexion and increased knee flexion for the SJ. While the vertical ground reaction forces are similar for both jumps, antero-posterior forces are significantly increased during the SJ. The dorsiflexor moment is reduced for SJ but knee flexion moment in increased demonstrating that vertical and horizontal jumps will not solicit joints in a similar manner.

Discussion

The CMJ and SJ receptions only demonstrate relatively low reproducibility. Joint moment reproducibility was lower than previously reported in the literature [2]. It is worth mentioning that despite being a more complex gesture, SJ is not less reliable than CMJ.

Our results have shown significantly different kinematic and kinetic behaviors in the sagittal plane at the ankle and the knee joints demonstrating the complementarity of these evaluations for injury risk prevention.

References

1. Andreoli et al., BMJ Open Sport Exerc. Med., 18: 780-788, 2019
2. Milner et al, J Biomech, 44:1814-1816, 2011.