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Letter to the Editor

Center of Pressure (COP) Analysis of Rotational Jump Landing on Dominant Foot

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Dear Editor-in-Chief

Humans have a differential development of the left and right brain hemispheres for rotational orientation, often resulting in a physiological preference for one side over the other, such as for hands and feet (1), but most studies report a significant right preference for both hands and feet (2). Although both the dominant hand and the dominant foot favor opposite directional rotation for walking and in-place rotation (3), the dominant foot may be a better indicator for studying laterality of direction in rotational jumping because it is less biased by cultural influences than the dominant hand (4). Analyzing the center of pressure (COP)-related variables in rotational jumping is a task to determine instability by observing postural control and strategy and reaction mechanisms, which are used as indicators of balance (5). Therefore, we aimed to analyze the variables of COP during landing according to the dominant foot and rotational jump direction.

The participants in this study were 33 college students with no history of musculoskeletal injuries over the past 12 months. The dominant foot was determined by calculating scores through the Footedness Preference Index (FPI) test (6). Through FPI (+100 to -100), +100 to +31 is right foot dominant (13 people), +30 to -30 is bipedal dominant (8 people), -31 to -100 is left foot dominant (12 people). The group was classified as follows: right dominant foot - age: 23.54 ± 3.23 years, height: 171.85 ± 8.69 cm, weight: 68.92 ± 13.50 kg, FPI: 53.08 ± 0.48; left dominant foot - age: 21.50 ± 1.91 years, height: 164.38 ± 6.13 cm, weight: 57.50 ± 7.14 kg, FPI: -50.00 ± 0.50; both feet - age: 25.70 ± 4.57 years, height: 173.33 ± 8.78 cm, weight: 70.10 ± 12.86 kg, FPI: 9.50 ± 0.52. Two pressure plates (K-force plates, K-Invent Biomecanique, Orsay, France, sampling rate; 75 Hz, 30 mm x 320 mm x 160 mm) were used to measure COP of both feet during rotational jump landings. All participants were randomized according to dominant foot group to perform three trials each of standing jump (SJ), left rotational jump (LRJ), and right rotational jump (RRJ), which were then averaged. Two-way ANOVA with repeated measures was performed using SPSS 24 (Armonk, New York, USA), and post hoc analysis was performed with LSD. The significance level was set at α=.05.

Table 1: Results of variables of Cop according to dominant foot during rotational jump

COP Variables (unit)	*DF*	*Rotational Direction*			*Factor*	*F*	*Sig.*
		SJ	***LRJ***	***RRJ***			
AP-amp (mm)	Right	23.68±11.01[c]	28.90±17.38	35.05±19.20	RD	4.179	.021*
	Left	26.59±6.58	34.90±17.35	37.59±14.52	DF	.207	.814
	Both	29.05±15.83	26.99±10.37	28.12±13.12	interaction	2.031	.104
ML-amp (mm)	Right	5.61±2.57[a, c]	9.23±5.86	10.26±5.75	RD	6.415	.003
	Left	6.24±1.43	12.10±6.69	11.05±8.14	DF	.441	.648
	Both	7.96±3.87	12.15±9.61	10.28±6.40	interaction	.425	.790
AP-velocity (mm/s)	Right	9.73±3.39[c]	11.82±5.22	12.51±4.65	RD	10.429	.001**
	Left	8.67±0.65	11.83±2.00	11.17±2.71	DF	.285	.754
	Both	10.99±2.32	14.51±11.24	11.30±2.15	interaction	.291	.091
ML-velocity (mm/s)	Right	4.26±1.62[a, c]	4.90±1.90	5.25±1.42	RD	4.283	.019*
	Left	4.31±0.99	5.63±1.63	5.23±1.40	DF	1.854	.177
	Both	5.50±1.07	5.98±1.67	5.85±1.15	interaction	.557	.695
COP surface (mm^2)	Right	99.94±65.41 [a, c]	176.62±156.79	217.14±188.52	RD	8.897	.001**
	Left	104.23±53.00	236.33±219.25	232.42±212.77	DF	.086	.918
	Both	148.99±120.47	207.21±188.51	185.47±168.63	interaction	.785	.540

Note. * Statistically Asymptotic Significant differences (Two-Way ANOVA with Repeated Measures)
[a, b, c] Statistically Significant differences in the pairwise comparison (LSD tests)
[a] = SJ vs. LRJ, [b] = LRJ vs. RRJ, [c] = SJ vs. RRJ
[*, a, b, c] Significant difference at $P < .05$
*AP-amp: anterior-posterior amplitude, ML-amp: medio-lateral amplitude, DF: dominant Foot, RD: Rotational Direction

As a result, Table 1 compares the variables of COP according to the dominant foot during rotational jumps. Significant differences were found in AP amplitude (F=4.179, P=.021), ML amplitude (F=6.415, P=.003), AP velocity (F=10.429, P=.001), ML velocity (F=4.283, P=.019), and COP surface (F=8.897, P=.001) according to the direction of rotation. Post hoc tests showed that AP amplitude was greater in the RRJ than in the SJ, and ML amplitude was greater in the LRJ and RRJ than in the SJ. AP velocity was faster in the RRJ than in the SJ, and ML velocity was faster in the LRJ and RRJ than in the SJ. COP surface was larger for LRJ and RRJ than SJ. However, there were no differences or interactions by dominant foot for any of the variables.

In summary, there was no effect of dominant foot on rotational jumps, but right and left rotational jumps had an effect on COP variables compared to SJ. These results suggest that consideration of the dominant foot was not necessary for stability in rotational jumping movements.

Conflict of interest

The authors declares that there is no conflict of interest.

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