

Dynamic Postural Stability Index: Questionable Reliability in the Absence of Movement Constraint Prior to Landing

Janae L. Myers, Isabel E. Sim-Campos, Maren E. Iverson, Donald V. Fischer
College of Saint Benedict/Saint John's University Department of Exercise Science and Sport Studies



Abstract

The Dynamic Postural Stability Index (DPSI) is a reliable measure of dynamic postural stability when the jump-landing task constrains the trajectory of the body prior to landing, such as by jumping over a hurdle or jumping to touch an overhead goal. **Purpose:** To examine test-retest reliability of the DPSI when body trajectory prior to landing is not constrained by a hurdle or overhead goal. **Methods:** Forty-eight healthy, physically active participants [24 males (20.6 ± 1.2 years of age, 86.1 ± 11.6kg, and 179.6 ± 8.3cm) and 24 females (19.75 ± 0.8 years of age, 62.8 ± 8.3kg, and 166.3 ± 6.8cm)] performed an anterior leap and a lateral leap from the left (non-dominant) leg, landed on the right (dominant) leg at a distance equivalent to 50% of their maximal leap distance, stabilized their body over the base of support as quickly as possible, and balanced for three seconds. Ground reaction forces in the x, y, and z directions, sampled at 200 Hz, were used to calculate the DPSI. One trial of each leap-landing direction was performed during three test sessions separated by at least 20 hours, but not more than 48 hours. Data from three test sessions were analyzed using an intraclass correlation coefficient (ICC 3,1) formula. **Results:** Test-retest reliability of the DPSI was judged to be questionable when landing from a forward leap (ICC = .711; 95% CI = .583 - .814) and lateral leap (ICC = .640; 95% CI = .493 - .763). **Conclusion:** The test-retest reliability of the DPSI when body trajectory prior to landing is not constrained by a hurdle or overhead goal is questionable. Therefore, it is recommended that DPSI testing continue to utilize jump-landing protocols that involve a jump over a hurdle or jump to touch an overhead goal as the test-retest reliability of the DPSI utilizing such protocols has been shown to be moderate to high.

Purpose

- To examine the test-retest reliability of the DPSI when body trajectory prior to landing is not constrained by a hurdle or overhead goal.

Methods

- Forty-eight healthy college students (24 men and 24 women) active in club or intramural sports participated in the study.
- Subjects completed two types of leaps (anterior and lateral) on three occasions (total of 6 leaps) with 20- to 48-hours between the three test sessions.
- All subjects leaped from their left (non-dominant) leg onto their right (dominant) leg in order to standardize spatial orientation and the visual field while completing the leap-landing task.
- The leap distance was equivalent to 50% of each subject's previously tested maximum distance for each leap.
- Subjects were instructed to land onto the center of an AccuPower® force platform, stabilize as quickly as possible on their right leg with their hands on their hips and balance for 3 seconds.
- Ground reaction forces in the x-, y-, and z-directions were sampled at 200 Hz for 3 seconds and used to calculate the DPSI.
- DPSI values were calculated using the DPSI equation.⁷

$$DPSI = [\sum\{(0-F_y)/BW\}^2 + \sum\{(0-F_x)/BW\}^2 + \sum\{(BW-F_z)/BW\}^2]/S$$
- Data were analyzed using an intraclass correlation coefficient (ICC 3,1) formula.⁸
- A one-way repeated measures ANOVA was used to test for systematic error associated with testing.

Discussion

- The leap-landing protocol utilized in the current study resulted in questionable DPSI test-retest reliability.
- By reducing the environmental constraints, compared to the protocols used by Wikstrom^{2,5} and Sell⁴, participants may have been afforded greater functional variability in completing the task, which may have contributed to the questionable reliability.
- The leap-landing task in the current study was substantially easier than the jump-landing tasks required by Wikstrom^{2,5} and Sell⁴, as indicated by mean DPSI values that were 47-60% lower in the current study.
- The relative ease of the task in the current study may have afforded participants more functional variability in completing the task, which may have contributed to the questionable reliability.



Figure 1. Measuring 50% of maximum leap distance.



Figure 2. Start of a forward leap.



Figure 3. Start of a lateral leap.

Introduction

- Control of dynamic posture promotes postural stability and is associated with enhanced athletic performance and prevention of sport related injury.¹
- Dynamic Postural Stability Index (DPSI) assesses an individual's ability to effectively transition from a dynamic to a static state, balancing on a single leg.^{2,3}
- DPSI is a composite measure of landing forces in the medial-lateral, anterior-posterior, and vertical directions.²
- The test-retest reliability of the DPSI is good to excellent when the body's movement prior to landing is constrained by a hurdle [ICC = .92 (forward); .86 (lateral)]⁴ or by touching an overhead object [ICC = .96 (forward)].^{2,5}
- The sensorimotor control necessary to effectively transition from a dynamic to a static state emerges from the interaction of the individual, task, and environment (Figure 4).⁶
- Removal of environmental constraints from the DPSI jump-landing protocols may increase the functional variability of the sensorimotor control system.⁶

Results

Table 1. Comparison of Dynamic Postural Stability Index scores for two leaps.

	Forward Leap	Lateral Leap
Mean DPSI	.166*	.158*
ICC (3,1)	.711**	.640**
95% Confidence Interval	.583 to .814	.493 to .763
ICC Rating ⁹	Questionable	Questionable
SEM	.023	.019
SEM as a Percentage of the Mean	13.7%	11.9%

*One-way repeated measures ANOVA revealed non-significant differences across the three trials; effect size was small for both forward and lateral leap.
 **Indicates significant results ($p < .001$).

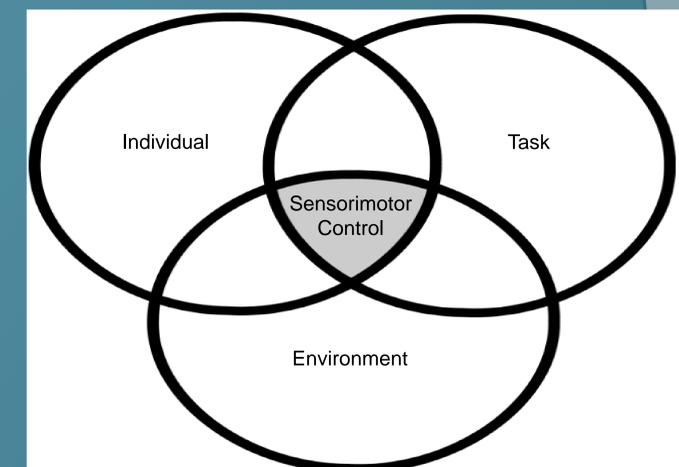


Figure 4. Sensorimotor control as an interaction between the individual, task, and environment.⁶

Conclusion

- When performing DPSI testing, established jump-landing protocols that have good to excellent test-retest reliability should be used, such as protocols that utilize a hurdle⁴ or an overhead goal.^{2,5}

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