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# Determining Leg Dominance Using the Unipedal Stance Test (UPST)

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## INTRODUCTION

While various techniques have been developed for determining the dominant leg in clinical and research settings, it is unclear whether the dominant leg is the leg that is more proficient at stability or mobility tasks<sup>1,2</sup>. One common test to predict the dominant leg is the Unipedal Stance Test (UPST), which is used to assess static single limb balance<sup>3</sup>. Another clinical method of determining the dominant leg is the Ball Kicking test (BKT)<sup>2,4,5</sup>. In the BKT, the dominant leg is determined to be the preferred leg used to kick the ball (kicking leg)<sup>2,4,5</sup>. For different research purposes, the stance leg has also been recognized as the dominant leg, providing a more stable base of support<sup>2,6</sup>. It has not yet been investigated whether or not there is a relationship between the kicking leg and the stance leg in the BKT and performance in the UPST.

The current lack of standardization in testing and nomenclature of leg dominance results in apparently contradictory findings regarding leg strength<sup>1,2</sup>. The preferred stance leg was shown to have significantly greater knee flexor and extensor strength in elite and subelite male soccer players<sup>2</sup>. Additional studies reported greater strength in the kicking leg or symmetry between the limbs<sup>2,5</sup>. Furthermore, in one study the subject's perceived stronger leg was shown to be weaker upon strength testing in 4/15 cases<sup>1</sup>.

Perceptions of the leg dominance have clinical relevance as well. A study of novice and experienced dancers showed that with practice and experience, the dancers developed a preferred stance leg for pirouette turns<sup>7</sup>. This study also used the terms dominant leg and support leg synonymously, in contrast to the BKT, which would have labeled the turning leg the stance leg and therefore the non-dominant leg<sup>7,2,5,8</sup>. Patients presenting in a clinical setting may exhibit a similar preferential stance limb if they perform repetitive activities with one side more than the other. This preferential lateralism may lead to clinical presentations of asymmetry and instability. Balance, including single limb stance should be assessed in most patients, especially the elderly population and those presenting with head injuries, peripheral neuropathy, and vestibular disorders<sup>3</sup>. Poor stance

time according to the UPST has been associated with increased fall risk and injury<sup>9</sup>. The elderly population is at a higher fall risk as strength and stability decrease with age<sup>10</sup>. Standardization of determining the relationship between the kicking leg and the stance leg in the BKT and performance in the UPST may help optimize treatment and care in these fragile populations.

## PURPOSE

The purpose of our study is to determine whether the kicking leg or stance leg as determined by the Ball Kicking test results in a longer unipedal stance time as determined by the UPST.



Figure 1. Subject performing the UPST.

## SUBJECTS

Forty-two healthy subjects (13 male, 29 female, mean age 26) with no history of lower limb pathology or balance impairments.

## METHODS

Subjects completed the Ball Kicking test and multiple trials of the UPST in a single session. For the Ball Kicking test, a ball was placed in front of the subject, and he/she was asked to kick it. The leg

selected to kick the ball was recorded. For the UPST, subjects stood barefoot on the floor with their arms crossed over their chest and eyes opened. Subjects then raised one foot without touching the stance limb and maintained balance on one leg for as long as possible. Stance time began when the foot was lifted off the ground and ended when: a) the raised foot touched the ground or the stance leg b) the arms began to uncross c) the stance limb shifted to regain balance d) the raised limb deviated from its original position e) the raised knee flexed or extended from its original position f) the upper torso bent or wavered in any direction from its original position or g) the subject moved from their original position in any other way. Three trials were completed on each limb, alternating limbs for each trial.

	Mean Balance Time (s)	Standard Deviation
Stance Leg	<b>89.43*</b>	<b>89.33</b>
Kicking Leg	<b>72.39*</b>	<b>51.89</b>

Table 1 summarizes the mean stance times for kicking and stance legs. \* P-value < 0.05

## RESULTS

Statistics:  
UPST times were compared between the best trials of the stance and kicking legs using a paired T-test with a one-tailed distribution. Means and SDs were calculated for: best UPST time for stability leg, best UPST time for kicking leg, outcomes where stability leg time > kicking leg time (S>K), and outcomes where stability leg time < kicking leg time (S<K).  
Findings:  
Results are summarized in tables 1 and 2. A significant difference was found between UPST times between stance and kicking legs, with calculated p value of 0.039. Fifty percent of participants (21/42) maintained longer SLS times on the stance leg as determined by the BKT.

Mean Difference S>K (s)	SD (S>K)	Mean Difference K>S (s)	SD (K>S)
<b>53.65</b>	<b>64.25</b>	<b>22.12</b>	<b>15.05</b>

Table 2 summarizes descriptive statistics of differences between UPST times comparing stability leg (S) to kicking leg (K).

## CONCLUSIONS

The significant difference in unipedal stance times between the kicking leg and the stance leg as determined by the ball kicking test suggests that young, healthy adults demonstrated a selective limb preference for stability tasks compared to mobility tasks related to improved stability and control. The stance limb, as determined by the Ball Kicking test, may be more adept at static balance compared to the kicking limb, which may challenge the currently-utilized concept of leg dominance. Additional investigation comparing the difference between limbs in static and dynamic balance activities would be beneficial with a more heterogeneous population.

## RELEVANCE

While it is widely assumed that the leg a person kicks with may be more proficient for functional activities that require strength, speed, and coordination activities, this study shows that the stance leg is actually more proficient during a static balance activity such as standing on one leg. This suggests the Ball Kicking test may be used to determine mobility and stability legs when performing standardized outcomes measure for falls risk or teaching functional activities such as a step-to pattern ascending and descending stairs.

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## IRB Approval

This study was granted approval for participation by human volunteers from the Institutional Review Board of the University of Puget Sound on October 10, 2014; Protocol #1415-004.

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