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Laura Broudy, SPT  
*University of Puget Sound*

Aerie Glowka, SPT  
*University of Puget Sound*

Katie Schaner, SPT  
*University of Puget Sound*

Michelle Wrigley, SPT  
*University of Puget Sound*

Danny McMillian, DSc, MPT, CSCS  
*University of Puget Sound*

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# The Nature of Movement Symmetry: Implications for Function and Injury Risk

Laura Broudy, SPT<sup>1</sup>; Aerie Glowka, SPT<sup>1</sup>; Danny McMillan, DSc, MPT, CSCS<sup>1</sup>; Katie Schaner, SPT<sup>1</sup>; Michelle Wrigley, SPT<sup>1</sup>

1. School of Physical Therapy

University of Puget Sound - Tacoma, WA, United States of America

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## Contact Information

Danny McMillan, DSc, MPT, CSCS  
DMcMillan@pugetsound.edu

## INTRODUCTION

In physical therapy practice human movement asymmetry is often identified and evaluated, however the threshold for defining asymmetry and the implications for function and injury risk are currently unclear. Physical therapists have an increasing role in the healthcare system as direct access providers to determine when intervention is appropriate. With this responsibility comes the need to make informed decisions regarding costs of care, risk of harm, and options for treatment. Movement asymmetries can present a variety of ways, including mobility, force production, balance, and neuromuscular control. To minimize activity and participation loss and health care costs it is important to correctly identify those who are at high risk due to movement asymmetries. Conversely, some movement asymmetries have a functional purpose and do not warrant physical therapy intervention. Physical therapists have a unique opportunity to restore optimal human movement through various interventions when potentially detrimental asymmetries are correctly identified.

## PURPOSE

The purpose of this literature review is to identify movement asymmetries that warrant physical therapy intervention in an effort to improve performance and minimize injury risk.

## METHODS

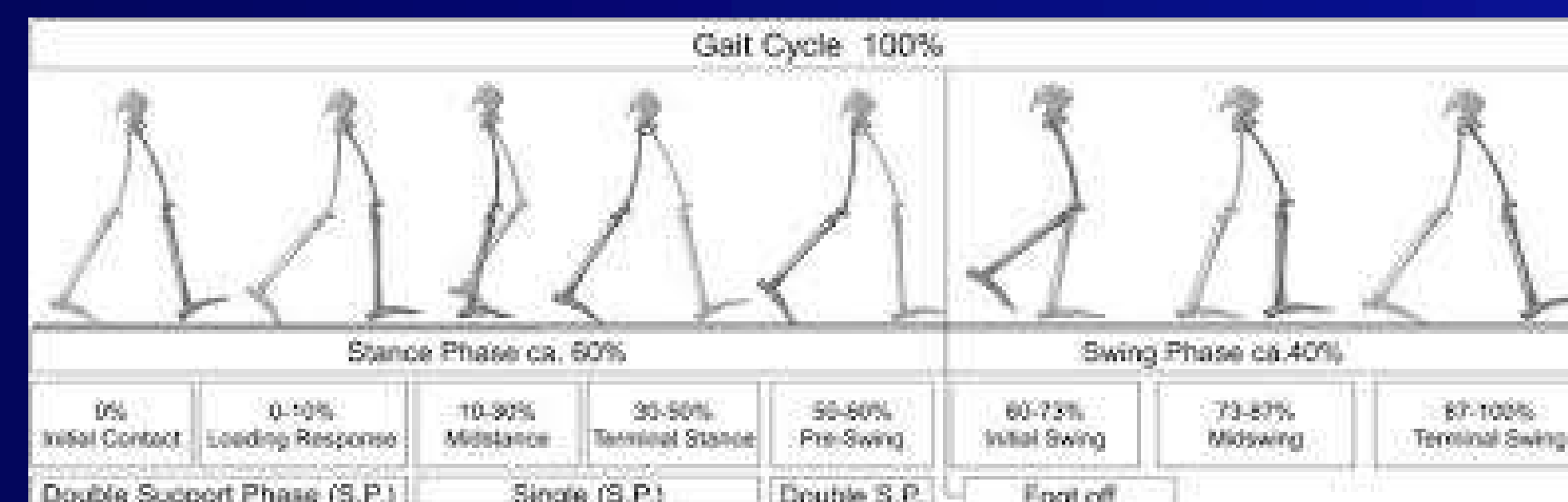
A thorough search of the literature was conducted between 11/2/14 to 6/16/16 using the following databases (PubMed, PEDro, SPORTDiscus, CINAHL) and search terms (limb asymmetry, kinematics, injury risk, force production asymmetry, strength, gait posture, balance, gait asymmetry, static balance, dynamic balance, postural control, YBT, SEBT, FMS, CAI).



## FUNCTIONAL IMPLICATIONS

### FORCE PRODUCTION

- Weight bearing asymmetries result in decreased functional mobility and increased time for task completion during ADL's and ambulation.<sup>4,15</sup>
- Positive correlation between force production asymmetry and decreased functional performance during various outcome measures and agility tests.<sup>7,10</sup>
- Asymmetrical force production is correlated with poor postoperative prognosis.<sup>4,10</sup>



### MOBILITY

- Overhead athletes displayed asymmetries in scapular position but were asymptomatic.<sup>11</sup>
- Local joint motion asymmetries throughout the gait cycle lead to an overall symmetrical gait.<sup>13</sup>
- OA results in decreased step length and hip ROM impairing the efficiency of gait.<sup>4,8</sup>

### BALANCE & NEUROMUSCULAR CONTROL

- Increased weight bearing asymmetry increases postural sway.<sup>1</sup>
- Balance and neuromuscular control asymmetries appear to decrease with functional training.<sup>14</sup>
- Performance on balance measures such as SEBT may vary by sport, team, and sex.<sup>16</sup>

## INJURY RISK IMPLICATIONS

### FORCE PRODUCTION

- Strength imbalances between limbs increases injury risk with sports that demand asymmetrical limb use.<sup>6</sup>
- H:Q imbalances increase an individual's risk for overuse injury.<sup>12</sup>
- Post-op imbalances increase the risk for re-injury and decrease the ability to safely RTS.<sup>7,10</sup>
- Weight bearing asymmetries lead to asymmetrical joint loading which can accelerate the rate of joint degeneration and injury risk.<sup>15</sup>



### MOBILITY

- Local mobility asymmetries in the presence of other pathology increase the risk for injury.<sup>17</sup>
- Hip and knee alignment that decreases medial joint compression decreases risk of OA.<sup>17</sup>
- Previous hamstring injury results in mobility asymmetry >15% at the hip and knee at toe off.<sup>3</sup>

### BALANCE & NEUROMUSCULAR CONTROL

- Increases static postural sway suggests increased risk of ankle injury.<sup>9</sup>
- SEBT and YBT predictive of injury with deficits in anterior direction, however not interchangeable.<sup>5</sup>
- Functional hop tests appear to be good predictors for safe RTS post ACL injury.<sup>10</sup>
- Targeted balance training aimed at decreasing functional asymmetry may decrease injury risk.<sup>14</sup>

## CONCLUSION

This literature review demonstrates that movement asymmetry in force production, mobility, and neuromuscular control has an impact on function and injury risk. Movement symmetry is important for function and reducing injury risk especially during tasks that demand LE weight bearing or for identifying readiness for return to sport. Based on the limited evidence available regarding the UEs, it is unclear to what degree asymmetry may impact function or injury risk. It appears UE asymmetry may not increase injury risk to the same extent as LE asymmetry.

Clinical implications for PT intervention:

- Address LE movement asymmetry >10% in the presence of other pathology or comorbidities.
- Finish the final 10% of rehabilitation for return to sport following an injury.
- Reduce fall risk by training weight bearing symmetry, decreased postural sway, and step length symmetry.
- Use targeted strength and balance training to improve neuromuscular control and decrease injury risk.
- Perform injury screens using valid outcome measures to accurately identify individuals at risk.

Areas for further research:

- Develop valid and reliable method to quantify neuromuscular control.
- Develop normative cutoff values for functional screens based on age, sex, and sport.
- Solidify normative ranges for H:Q ratios and other strength testing under various demands.
- Address the discrepancy between RTS (90% symmetry) and injury risk (10% asymmetry).
- Further assess UE asymmetry in relation to function and injury risk.

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