



# Describing the Gait Cycle of Bilateral Transfemoral Amputees

## A Preliminary Analysis

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### INTRODUCTION

Persons with unilateral transfemoral amputation from vascular disease are at risk of a second amputation within 5y of the first. Specific epidemiologic data on this group is elusive for many reasons. Some include the fact that bilateral transfemoral amputation (BTFA) can so severely impair ambulation ability that many will adopt wheelchair mobility and potentially participate in studies at lower levels than their ambulatory peers. One study estimated the prevalence of bilateral lower limb amputees at <1% of the entire sample. Because BTFA represent a very small group within an already small group of bilateral amputees, data regarding their function is rare. Such data would be useful for instance in setting rehabilitation goals. Data regarding the general gait cycle of the BTFA is one such gap in present prosthetic literature. Therefore, this study's purpose was to describe the gait cycle of community ambulating persons with BTFA.

### METHOD

Records were reviewed following a BTFA clinic where spatiotemporal gait data were collected. Subjects traversed a GaitRite walkway at self-selected walking speed five times. All parameters were collected however only swing, stance, single and double support percentages of the gait cycle were of interest in this preliminary analysis. Patients were asked which limb they perceived to be the dominant limb by answering the question: "With which leg would you kick a ball?" This was corroborated by measuring and comparing which residuum was longer.

### RESULTS

Seventeen community ambulating patients with BTFA participated in the session. Mean ( $\pm$ SD) patient age was 28.4(8.8)y and BMI was 23.8(2.5)kg/m<sup>2</sup>. Thirteen of 17 reported Right limb dominance whereas 6/17 limb pairs had a longer Right limb, 5 limb pairs were equal length and 6/17 had longer Left residual limbs. All subjects used full length prostheses. Prosthetic socket, suspension, feet and knee combinations varied. Two patients lost their legs to infection, one was congenital and the remaining 14 were of traumatic etiology.

In terms of stance versus swing phase, classical gait literature divides these into 60 and 40% respectively. We observed that BTFA spent very close to the typical stance at 60% bilaterally with a slight increase on the dominant

side compared to the non-dominant side (64.2 $\pm$ 2.6% vs. 60.8 $\pm$ 2.2% respectively). Less than the classically reported 40% of the cycle was spent in swing phase (35.8 $\pm$ 2.6% dominant vs. 33.7 $\pm$ 2.2% non-dominant).

For single support, again, 40% of the cycle is classically reported however this group spent less of the cycle in single support (36.3 $\pm$ 2.3% dominant vs. 34.2 $\pm$ 2.5 non-dominant). Conversely, a greater percent of the cycle was spent in double support (28.0 $\pm$ 4.4% dominant vs. 27.0 $\pm$ 4.5% non-dominant) than is classically reported (20%).

### DISCUSSION

This preliminary analysis of ambulatory BTFA shows that greater time is in fact spent in stance phase than in swing phase. The greater portion of this increased stance is in double support and as anticipated, the dominant limb presented with a greater percentage of the cycle in stance compared to the non-dominant side. This suggests that BTFA are adopting a gait pattern that favors stance phase stability which has implications for other elements of the prosthesis. For instance it would be important that the BTFA be very comfortable in the socket and have prosthetic feet and knee components that can be stable but rapidly and predictably transition into and out of swing phase with a high degree of knee stability.

### CONCLUSION

Persons with BTFA vary the percentage of their gait cycles spent in stance versus swing and single versus double limb support compared with classically reported gait values. The differences put more time primarily in double limb support which is common in diagnostic groups whose gait patterns are known to be less stable.

### CLINICAL APPLICATIONS

Understanding differences in the gait cycle of persons with BTFA, can assist prosthetists with appropriate component selection and with interdisciplinary goals for therapy.

### REFERENCES

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