

Reference

Morishima, R.¹, Hara, T.¹, Mizuno, Y.¹, Hisano, G.², Pillet, H.², Kobayashi, T.³. & Hobara, H.⁴.

Associations between weight-bearing asymmetry and demographic factors during quiet standing in individuals with unilateral transfemoral amputation

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[OpenAccess](#)

Products

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- Major Findings
- On the effect of demographic variables and prosthesis characteristics (MPK vs. NMPK) on weight-bearing asymmetry:
- Within the unilateral transfemoral amputation (uTFA) population, Paralympians exhibited less weight-bearing asymmetry in quiet standing than non-Paralympians

- In Paralympians, 10% more weight was on the non-prosthetic leg than on the prosthetic leg whereas in the overall uTFA sample, 36% more weight was on the non-prosthetic leg (0.1 vs. 0.36).

→ Participants with uTFA demonstrated 4 times greater weight-bearing asymmetry compared to able-bodied individuals in quiet standing

- Interlimb loading asymmetry was 4 x as high in uTFA compared to able bodied individuals (0.09 vs. 0.36)

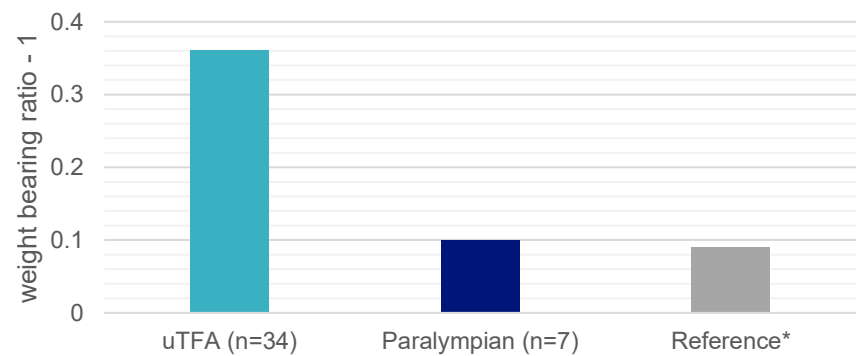


Figure 1: Asymmetry in weight bearing indicated by the difference from perfect symmetry (WBR-1); *reference of abled-bodied mean (1.09, CI: 0.83–1.35) reported by Dickstein et al., 1984 (DOI: 10.1093/ptj/64.1.19).

- No significant differences in weight-bearing ratio (WBR) were found according to prosthetic type (MPK vs. NMPK) (p = 0.59)

→ Weight-bearing asymmetry during quiet standing was not significantly associated with demographic variables:

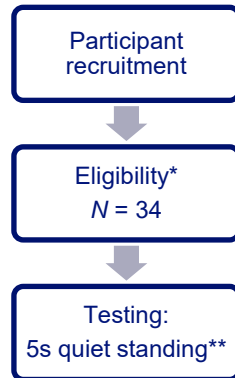
- Age, gender, body height, body mass, time since amputation (TSamp), residual leg length

Population	Subjects:	n = 34 (8 females, 26 males; 14 MPK vs. 20 NMPK; 7 Paralympians vs. 27 non-Paralympians)
	Previous product:	n.r.
	Amputation causes:	n.r.
	Mean age:	31.0 ± 9.5 years

Mean time since amputation: 11.5 ± 8.6 years
MFCL: K3 – K4

Study Design

Cross-sectional observational study:



* Inclusion criteria: moderately physically active, regular user of a unilateral transfemoral prosthesis; Exclusion criteria: neuromuscular disorders, comorbidities, functional impairments that could affect standing ability

** In the testing phase, each participant performed 5 seconds of quiet standing on two separate force plates with the TFA-leg with prosthesis and non-prosthesis leg (TF-40120-CL and TF-40120-CR; Tec Gihan, Kyoto, Japan).

Results

Functions and Activities								Participation	Environment
Level walking	Stairs	Ramps, Hills	Uneven ground, Obstacles	Cognitive demand	Metabolic Energy Consumption	Safety	Activity, Mobility, ADLs	Preference, Satisfaction, QoL	Health Economics

Category	Outcomes	Results	Sig. ^a		
Level walking	Weight bearing ratio (WBR) ^b	uTFA bear more weight on their intact leg than their prosthetic leg compared to the reference. The subgroup of Paralympians within uTFA is close to the reference.	n.a.		
	Group comparisons				
			uTFA	Paralympians	Reference
		WBR	1.36	1.10	1.09
	WBR MPK vs. NMPK	No statistical difference between microprocessor-controlled and not microprocessor-controlled knees in weight bearing symmetry (p = 0.59; power = 0.04).	0		
	WBR Paralympic vs. non-Paralympic	Significant difference between paralympic and non-paralympic uTFAs. Paralympians demonstrated more symmetrical weight distribution (p < 0.05; power = 0.72; effect adjusted: p < 0.01; ES: η ² = 0.19).	++		

Category	Outcomes	Results	Sig. ^a
Effect on WBR	WBR male vs. female	No statistical difference between female and male uTFAs in weight bearing symmetry ($p = 0.97$; power = 0.05).	0
	Effect of residual leg length on WBR	No effect of residual leg length (prosthetic leg) on weight bearing symmetry ($p = 0.17$; power = 0.04).	0
	Effect of age on WBR	No effect (correlation) of age on weight bearing symmetry in uTFAs ($r = -0.16$; $p = 0.37$)	0
	Effect of body height on WBR	No effect (correlation) of body weight on weight bearing symmetry in uTFAs ($r = -0.09$, $p = 0.62$)	0
	Effect of body mass on WBR	No effect (correlation) of body mass on weight bearing symmetry in uTFAs ($r = -0.25$; $p = 0.15$)	0
	Effect of TSamp on WBR	Time since amputation had no effect (correlation) on weight bearing symmetry in uTFAs ($r = -0.33$; $p = 0.62$)	0

^a no difference (0), positive trend (+), negative trend (–), significant (++/--), not applicable (n.a.) significance set at $p < 0.05$; trends set at $0.1 > p > 0.05$

^b Explanation: A value of 1 equals perfect symmetry. In case of uTFA, numbers higher 1 mean more weight on the intact leg whereas less 1 means more weight on the prosthetic leg.

Author's Conclusion

“These findings indicate that athletic proficiency may be associated with more symmetrical weightbearing during quiet standing in individuals with uTFA. However, the underlying mechanisms remain unclear, and further research is needed to confirm these observations and explore the role of sports participation in postural balance and asymmetry-related outcomes” (Morishima et al., 2026)

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