Reference

Wolf EJ, Everding VQ, Linberg AL, Schnall BL, Czerniecki JM, Gambel JM.

Walter Reed National Military Medical Center, Department of Orthopaedics and Rehabilitation, Bethesda, MD, USA.

Assessment of transfemoral amputees using C-Leg and Power Knee for ascending and descending inclines and steps

Journal of Rehabilitation Research & Development 2012; 49(6):831–842.

Products

C-Leg vs Power Knee

Major Findings

With C-Leg compared to Power Knee:

→ **During stair descent ankle power generation decreased on sound side based on increased loading of the prosthetic limb**

→ **Step length when walking on ramps is increased on the prosthetic side and tends to be increased on the sound side**

→ **Increased gait symmetry when descending a ramp**

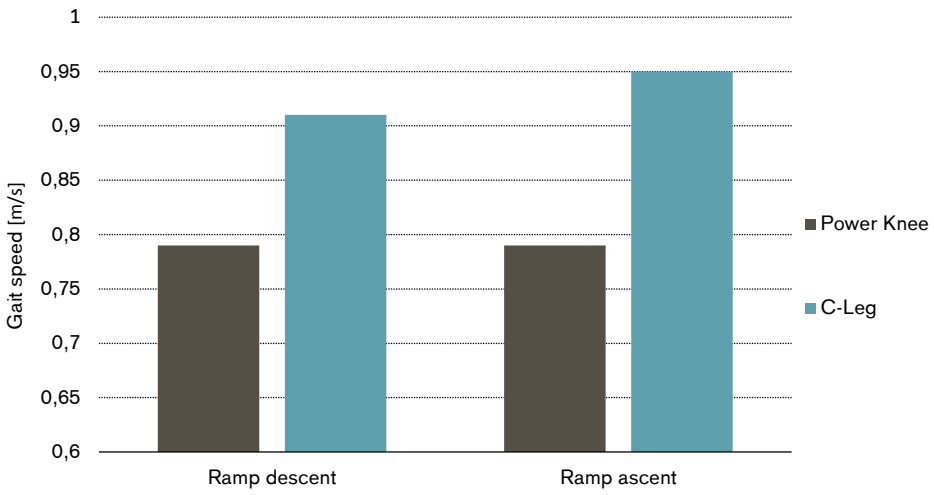
Shorter stance phase on the sound side

Longer stance phase on the prosthetic side

→ **Increased confidence**

Gait speed during ramp descent and ascent as well as during stair descent tends to be increased

Ramp gait speed

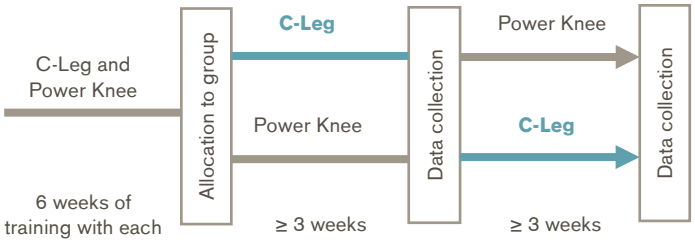


Population

Subjects:	5 unilateral, transfemoral amputees
Previous prosthesis:	not reported
Amputation causes:	trauma
Mean age:	not reported
Mean time since amputation:	2.5 yrs (± 1.6 yrs)
MFCL:	K3 - K4 (medium to high daily activity levels)

Study Design

Interventional, single crossover design:



Results

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 for C-Leg compared to Power Knee**			
		Descending	**Sig.***	**Ascending**	**Sig.***
Stairs	Gait speed	Increased	+	Decreased	–
	Sound side stance phase (% of gait cycle)	Shorter	+	Longer	–
	Prosthetic side stance phase (% of gait cycle)	Longer	+	Longer	+
	Peak ankle power generation on sound side	**Decreased**	**++**	Increased	–
	Peak knee power absorption on sound side at early-stance phase	No difference	0	Decreased	+
	Peak knee power absorption on sound side at late-stance phase	Decreased	+	**Increased**	**– –**
	Peak hip power generation on sound side	No difference	0	Decreased	+
Ramps, Hills	Gait speed	Increased	+	Increased	+
	Stance phase on sound side (% of gait cycle)	**Shorter**	**++**	Shorter	+
	Stance phase on prosthetic side (% of gait cycle)	**Longer**	**++**	Longer	+
	Sound side step length	Increased	+	Increased	+
	Prosthetic side step length	**Increased**	**++**	**Increased**	**++**
	Peak ankle power generation on sound side	Decreased	+	Increased	–
	Peak knee power absorption on sound side at early-stance phase	No difference	0	Increased	–

Category	Outcomes	Results for C-Leg compared to Power Knee			
		Descending	**Sig.***	**Ascending**	**Sig.***
	Peak knee power absorption on sound side at late-stance phase	Increased	–		
	Peak hip power generation on sound side	Decreased	+	**Increased**	**– –**

* no difference (0), positive trend (+), negative trend (–), significant (++/––), not applicable (n.a.)

Author's Conclusion

"In conclusion, there were functional differences, both temporal-spatial and kinetic, between the Power Knee (PK) and the C-Leg while ascending and descending ramps and stairs. The main functional differences occurred at the nondisabled and prosthetic knees during stair ascent, a result that was expected because of the design of the PK, which provides active propulsion. The PK was able to significantly reduce the power generated by the nondisabled knee while ascending stairs step-over-step. The C-Leg required users to produce less ankle power generation on the nondisabled limb during stair descent. Also, C-Leg conditions resulted in temporal-spatial differences that included increased speed (although not significant) and greater symmetry between the nondisabled and prosthetic limbs during ramp and stair descent. These data show that significantly more work is required by the nondisabled limb while ascending stairs step-over-step with a prosthesis that does not provide active extension. The data also imply that technology as complex as a powered knee prosthesis may not yet be ideal and only provide a benefit over current knee units during certain tasks." (Wolf et al. 2012)