

## Reference

Burnfield JM, Eberly VJ, Gronely JK, Perry J, Yule WJ, Mulroy SJ.

# Impact of stance phase microprocessor-controlled knee prosthesis on ramp negotiation and community walking function in K2 level transfemoral amputees

Prosthetics and orthotics international 2012; 36:95–104.

## Products

### C-Leg Compact vs NMPCKs

## Major Findings

With C-Leg Compact compared to NMPCKs:

#### → Increased walking velocity during ramp ambulation

Walking velocity increased by 28% during ramp ascent

Walking velocity increased by 36% during ramp descent

#### → Decreased risk of falling

Time required to complete timed up and go (TUG) decreased by 38%

#### → Improved balance confidence

Activities-specific balance confidence scale (ABC) score increased by 26%

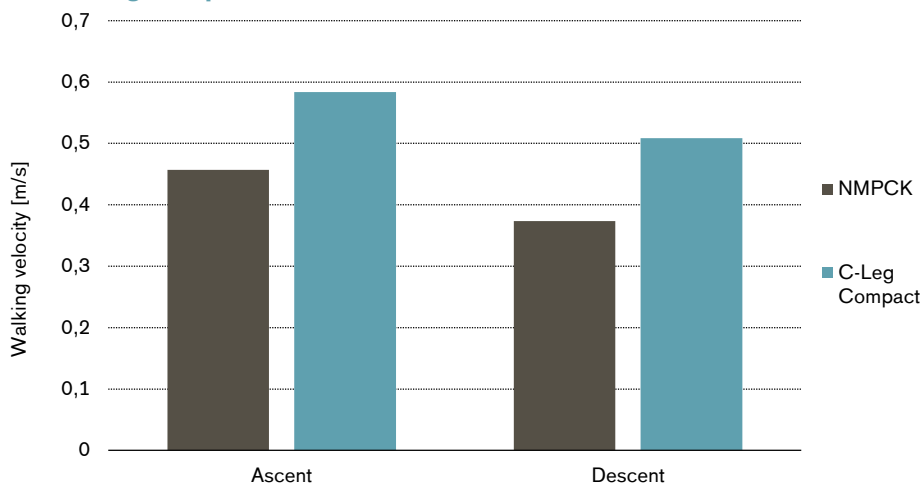
#### → Improved mobility

Prosthetic evaluation questionnaire (PEQ) improved by 25%

#### → More symmetrical gait pattern during ramp ambulation

Duration of single limb support phase on prosthetic side increased by 17% during ramp ascent and by 17% during ramp descent

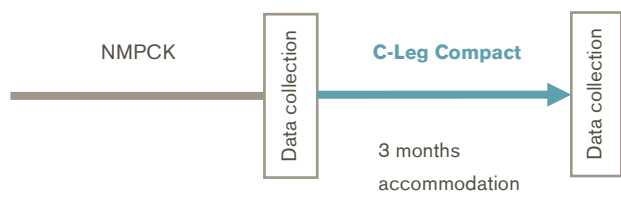
### Increased walking velocity during ramp ascent and descent with C-Leg Compact



Each participant ascended and descended a 6.1 m ramp (12° slope) at their self-selected speed using their customary walking aid.

<b>Population</b>	Subjects:	10 unilateral, transfemoral amputees
	Previous prosthesis:	NMPCKs
	Amputation causes:	n.a.
	Mean age:	62 yrs ( $\pm$ 11.3 yrs)
	Mean time since amputation:	9 yrs (2.5 – 21 yrs)
	MFCL:	K2

**Study Design**      Interventional, pre- to post-test 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 Compact vs NMPCKs	Sig.*
Ramps, Hills	Motion analysis Ramp ascent	<b>Walking velocity increased by 28%.</b>	<b>++</b>
		<b>Stride length and cadence increased each by 14%.</b>	<b>++</b>
		<b>Duration of single limb support phase on the prosthetic side increased by 17% relative to duration of gait cycle.</b>	<b>++</b>
	Motion analysis Ramp descent	<b>Duration of stance phase on the sound side decreased by 5%.</b>	<b>++</b>
		<b>Increased peak hip extension (+5°) and thigh extension (+2.1°) on the sound side during single limb support phase.</b>	<b>++</b>
		<b>Walking velocity increased by 36%.</b>	<b>++</b>
		<b>Stride length increased by 17% and cadence increased by 16%.</b>	<b>++</b>
		<b>Duration of single limb support phase on the prosthetic side increased by 17% relative to duration gait cycle.</b>	<b>++</b>
		<b>Heel off occurred earlier on sound side (at 38.8% vs 24.6% of gait cycle) and on prosthetic side (at 44.9% vs 54.9% of gait cycle).</b>	<b>++</b>
		<b>Increased peak knee flexion (+12.9°) and ankle dorsiflexion (+4.9°) on the prosthetic side during single limb support phase.</b>	<b>++</b>

Category	Outcomes	Results for C-Leg Compact vs NMPCKs	Sig.*
		<b>Increased peak hip extension (+6.4°) and thigh extension (+3.1°) on the sound side during single limb support phase.</b>	<b>++</b>
Safety	Activities-Specific Balance Confidence Scale (ABC)	<b>The ABC score increased by 26%.</b>	<b>++</b>
	Timed Up and Go Test (TUG)	<b>Time required to complete TUG was 38% shorter (17.7 vs 24.5 s).</b>	<b>++</b>
Preference, Satisfaction, Quality of Life (QoL)	Prosthetic Evaluation Questionnaire (PEQ) Mobility Subscale	<b>The PEQ Mobility score increased by 25%.</b>	<b>++</b>
	Houghton Scale (to measure prosthetic use)	The Houghton Scale score showed a tendency to be increased (16% higher).	<b>+</b>
	Subjective comments	Positive attributes for C-Leg Compact: moving from sit to stand more naturally, standing longer, taking longer steps, walking faster, fatiguing less, greater stability, greater confidence in new places, capacity to walk and think about other things or walk and talk on phone, and reduced rear and/or occurrence of falls, walk down a steep ramp, walk on uneven terrain, absence of falls. Negative attributes for C-Leg Compact: Too heavy, had to be charged every night, could not be used around a pool.	n.a.

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

### Author's Conclusion

Stability was greater ascending and descending ramps in the C-Leg Compact prosthesis compared to the NMPK as evidenced by the faster velocity, longer stride length, greater proportion of time spent in residual limb single limb support, reduced reliance on assistive devices, and the capacity to sustain residual limb knee flexion throughout single limb support. Patient preference to keep the C-Leg Compact versus the NMPK confirms empirical findings of improved performance in the C-Leg Compact. These results have important therapeutic implications when selecting prosthetic knee componentry for more physically disabled individuals who have experienced a transfemoral amputation. The C-Leg Compact may provide important benefits for function and stability for more deconditioned K2 level walkers and those at risk for injurious falls.

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