Reference

Kannenberg A, Zacharias B, Pröbsting E.

Benefits of microprocessor-controlled prosthetic knees to limited community ambulators: Systematic review

Journal of Rehabilitation Research & Development (JRRD) 2014; 51(10): 1469-1496.

Products

C-Leg / Compact vs NMPKs

Major Findings

With C-Leg / Compact compared to NMPKs:

→ Limited community ambulators (MFCL2) are safer with C-Leg

Decreased number of stumbles and falls by 80%.

Increased balance in Activities of Daily Living (ADLs)

→ Limited community ambulators (MFCL2) benefit from C-Leg in walking

14-25 % faster walking on level ground

20% faster on uneven ground

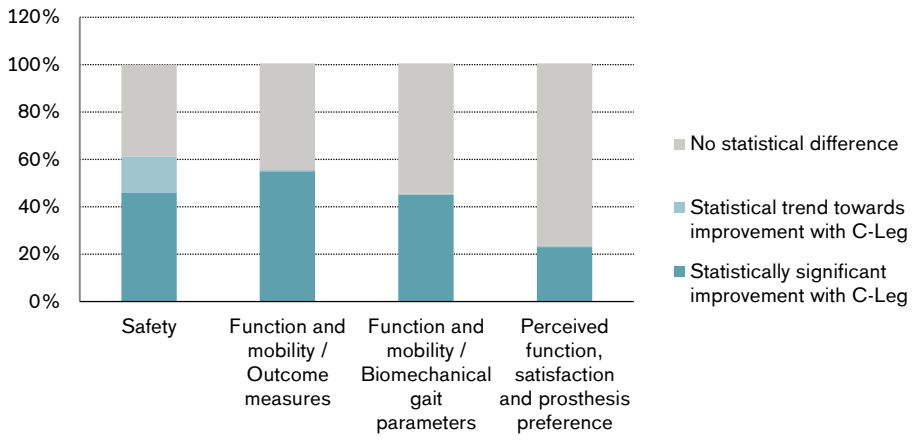
Improved walking quality on stair and ramp desent

→ Limited community ambulators (MFCL2) prefer C-Leg over NMPKs

Up to 90% prefer C-Leg over their previous NMPK

→ No significant benefits nor trends towards an advantage of NMPKs were reported compared to the C-Leg or Compact

Outcome measures showing the benefits of C-Leg



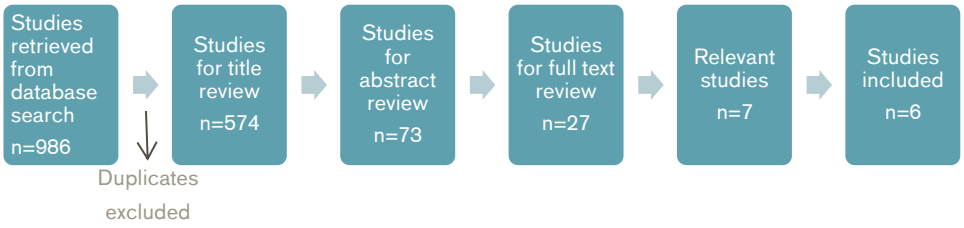
160 outcome measures were analysed in this review. The graph shows the percentage of outcome measures reporting a significant improvement ($p<0.05$) or statistical trend ($0.05<p<0.1$) towards a benefit for C-Leg or if no statistical difference was found. No benefits were reported for the NMPKs when compared to C-Leg.

Population

Subjects:	57 limited community ambulators
Amputation causes:	Dysvascular, PVD or Diabetes (20), Trauma (31), Other (6)
Mean age:	57.1 – 67.1 years
MFCL:	MFCL 2

Study Design

Systematic Review:



Included publications:	Crossover design (4), Randomized double crossover design (2)
Quality assessment:	Hofstad checklist with 13 criteria for methodological quality (selection of patients, intervention, statistical validity) resulting in a high (0), moderate (4) or low (2) quality rating

Results

Functions and Activities								Participation	Environment
Level walking	**Stairs**	**Ramps, Hills**	**Uneven ground, Obstacles**	**Cognitive demand**	**Energy**	**Safety**	**Activity, Mobility, ADLs**	**Preference, Satisfac-tion, QoL**	**Health, Economics**

Category	Outcomes	Results for C-Leg and C-Leg Compact	Reference
Level Walking	Walking speed on level ground	**Subjects walk about 14 to 25 percent faster on level ground.** (C-Leg and Compact)	Kahle 2008, Eberly 2014
Stairs	Walking quality	**Walking quality improved significantly when walking down stairs.** (C-Leg)	Hafner 2009, Kahle 2008
Ramps, Hills	Walking speed on ramps	**Subjects walk almost 30 percent faster when descending a slope or hill.** (C-Leg)	Hafner 2009, Burnfield 2012
		Walking quality improved significantly when walking down a slope. (Compact)	Hafner 2009, Burnfield 2012
Uneven Ground	Walking speed on uneven ground	**Subjects walk around 20 percent faster on uneven surfaces.** (C-Leg and Compact)	Hafner 2009, Kahle 2008
Cognitive Demand	Walking speed while and accuracy of divided attention tasks	**Walking speed while attention tasks in-creased significantly** while accuracy of the tasks did not differ. (C-Leg)	Hafner 2009
Safety	Reported stumbles and falls	**The number of falls decreased by 80 per-cent.** (C-Leg)	Kahle 2008
		Number of uncontrolled falls and number of stumbles decreased significantly. (C-Leg)	Hafner 2009

Category	Outcomes	Results for C-Leg and C-Leg Compact	Reference
		Frustration with falls was reduced and confidence while walking improved. (C-Leg)	Hafner 2009
	Activities-Specific Balance Confidence Scale (ABC)	**The perceived balance in 16 ADLs improved significantly. The ABC score fell below the cutoff score of 67 indicating a low risk of falling.** (Compact)	Burnfield 2012
	Timed Up and Go Test (TUG)	**Time required to complete TUG was shorter. The value fell below the cutoff value of 19s which indicates a risk of multiple falls.** (Compact)	Burnfield 2012
Activity, Mobility, ADL	MFCL	44 to 50 percent of the subjects improved their mobility grade to MFCL 3. (C-Leg)	Hafner 2009 / Kahle 2008
	ADAPT (Assessment of Daily Activity Performance in Transfemoral Amputees)	**The performance in ADLs improved especially in activities requiring adequate balance.** (C-Leg and Compact) **The perceived difficulty to perform ADLs requiring sitting down and standing up and those heavily dependent on the patient's prosthesis-related skills was reduced.** (C-Leg)	Theeven 2011
Preference, Satisfaction, Quality of Life	Prosthetic Evaluation Questionnaire (PEQ) and Addendum	K2: Satisfaction tended to be improved by 21 percent. 8 out of 9 subscales tended to be improved. (C-Leg)	Hafner 2009
		The PEQ Mobility score increased by 25%. (Compact)	Burnfield 2012
		The PEQ Ambulation improved by 11%, Residual health by 16%, Utility by 12% and Satisfaction with walking by 24% for the total group. (C-Leg) **The Residual health improved by 22% and Utility by 12% for the total group.** (Compact)	Theeven 2012
	Houghton Scale(to measure prosthetic use)	The Houghton Scale score showed a tendency to be increased (16%higher). (Compact)	Burnfield 2012
	Preference Survey	70 % preferred C-Leg, 23% preferred C-Leg Compact and only 7 preferred their previous NMPK.	Theeven 2011
		90% preferred C-Leg over their previous prosthesis. (C-Leg)	Kahle 2008

Bold: significant results

Author's Conclusion

"The results of this systematic review of clinical trials on interventions with MPKs in individuals with a unilateral TFA and MFCL-2 mobility grade suggest that these subjects may significantly reduce the number of falls and their risk of falling, improve their balance, and better perform activities of community ambulation that are

actually categorized as part of the MFCL-3 mobility grade. Because these results have been derived from studies with low to moderate methodological quality in a yet limited number of patients, trial fittings with different types of MPKs (MP stance only or MP stance and swing control) may be considered to evaluate whether an individual benefits from using an MPK compared with NMPKs usually prescribed for MFCL-2 individuals. Criteria for appraising success or failure of the trial fitting based on the 2MWT, AMP, TUG, and ABC have been suggested. Given the challenges to objectify the current general and ambiguous definitions of the MFCLs, an evidence-based and unambiguously quantifiable functional classification or one or more validated outcome measures to corroborate the classification would help better define patient groups to be subjected to clinical research and sharpen coverage and reimbursement criteria." (Kannenberg et al, 2014)