Reference

Silvia Caggiari [1], Tim Randell [2], Chantel Ostler [3,4], Alex Dickinson [4,5] and Peter Worsley [1,4]

Evaluation of activity and function before and immediately after the provision of a microprocessor knee in individuals with transfemoral amputation

Prosthetics and Orthotics International, 49(4), 368–377. (2025).
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Products

C-Leg, Kenevo

Major Findings

With microprocessor-controlled knees (MPKs) (C-Leg, Kenevo, Rheo, Plie) compared to non-MPKs:

→ MPK provision improved functional test outcomes and self-reported scores compared to nMPK use:

- 33.3% higher activities-specific balance confidence (ABC, p<0.05)
- 15.4% higher reintegration of normal living index (RNLI, p<0.05)
- 15.3% higher walking performance in clinical tests (2MWT, p<0.05)
- 30.4% higher patient-reported prosthesis function (PEQ total, p<0.05)

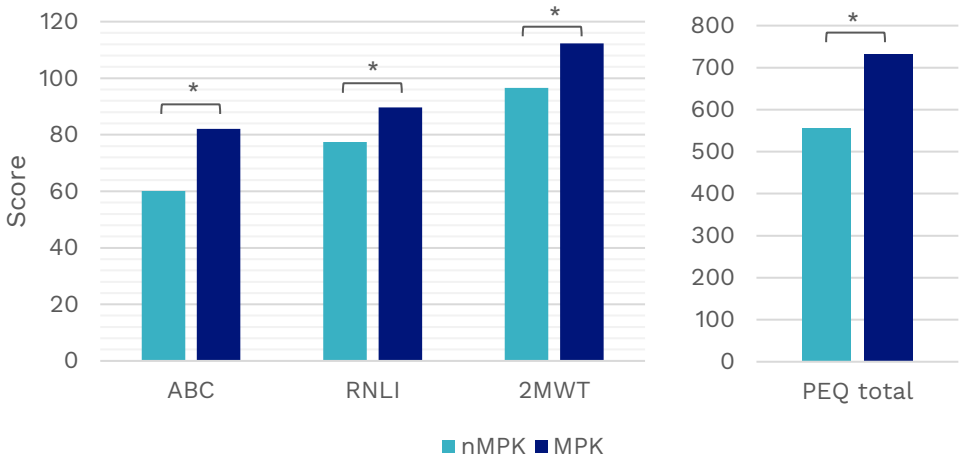


Figure 1. Mean values of self-reported outcomes (ABC, RNLI, PEQ total) and 2MWT. *indicates a statistically significant difference (p<0.05).

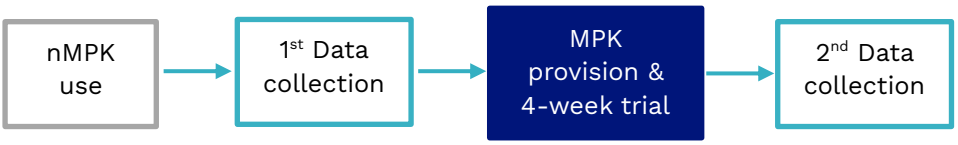
→ Physical activity measured by number of steps, number of sit to stand events, active, upright and sedentary time did not exhibit statistically significant changes within the 4 weeks of the study

Population

Subjects:	14 (12 male, 2 female)
Previous nMPK:	OB: *3R60, 3R80, 3R95* Others: Mauch, Endolite PSPC, NOP4/NOP5, NOFM2, ESK, Smart IP, Paso
Provided MPK:	C-Leg (9), Kenevo (1), Plie (3), Rheo (1)
Amputation causes:	trauma (3), peripheral vascular disease (3), tumor (3), congenital (2), pain-related (2), infection (1)
Mean age:	57 years (range: 41-78 years)
Mean time since amputation:	22 years (range: 1-44 years)
MFCL:	not reported

Study Design

Observational pre-post cohort study:



The individuals were assessed before and after a 4-week microprocessor-controlled knee (MPK) trial following routine clinical provision. The first data collection was performed with their previous nMPK knee.
The data collection included self-reported scores and functional tests. Also, on seven consecutive days following both days of data collection, activity monitoring was performed.

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 for MPKs vs nMPKs *	Sig.[a]
Level Walking	Activities-Specific Balance Confidence Scale (ABC)	Mean self-reported balance confidence (ABC scores) significantly improved after MPK provision. 10 out of 14 patients reported an at least 20% higher score after MPK provision.	++
		nMPK: 60.1 | MPK: 82.05 | Difference: 33.3%	
		Higher ABC scores with MPK correlated with - a higher distance in the 2MWT (r=0.62). - a lower time in the TUG (r=-0.57). - a higher number of sit to stand events (during actimetry) (r=0.69). Higher ABC scores with nMPK correlated with higher sedentary times (r=0.55).	++
	2 Minute Walk Test (2MWT) (m)	MPK use significantly increased short-distance walking capacity, measured with 2MWT. The improvement in distance was found in 12 out of 14 patients.	++
		nMPK: 96.6 ± 32.1 | MPK: 112.3 ± 34.4 | Difference: 15.3%	
		Higher 2MWT results during the use of MPKs correlated with - a higher number of steps (during actimetry) (r=0.58).	++
	Timed Up and Go Test (TUG) (s)	Similar values were measured at both time points	0
		nMPK: 29.8 ± 11.1 | MPK: 28.9 ± 15.9 | Difference: 8.7%	

<table>
<tr><th>Category</th><th>Outcomes</th><th>Results for MPKs vs nMPKs *</th><th>Sig.[a]</th></tr>
<tr><td></td><td></td><td>Lower TUG time during the use of MPKs and nMPKs correlated with
- A higher number of steps (during actimetry) (MPK: r=-0.77; nMPK: r=-0.77).
- A higher 2MWT (MPK: r=-0.83; nMPK: r=-0.59).
- A higher upright time (MPK: r=-0.63; nMPK: r=-0.68).
For nMPK use a higher TUG time was also correlated with lower active time (r=-0.69)</td><td>++</td></tr>
<tr><td>Activity, Mobility, Activities of Daily Living (ADLs)</td><td>Actimetry</td><td>There were no significant changes in the activity-based parameters: number of steps, active time, upright time, sedentary time, number of sit to stand events (high degree of intersubject variability, limited mean difference between time points).</td><td>0</td></tr>
<tr><td>Preference, Satisfaction, Quality of Life (QoL)</td><td>Reintegration to normal living index (RNLI)</td><td>MPK provision significantly enhanced perceived participation in daily and social life. For the majority the improvement was >10%.
<table><tr><th>nMPK</th><th>MPK</th><th>Difference</th></tr><tr><td>77.4</td><td>89.6</td><td>15.4%</td></tr></table></td><td>++</td></tr>
<tr><td></td><td></td><td>A higher RNLI was correlated with a lower number of steps (r=-0.61) and lower active time (r=-0.72) with nMPK.</td><td>++</td></tr>
<tr><td></td><td>Prosthesis Evaluation Questionnaire (PEQ)</td><td>Users perceived substantial and significant improvements in prosthesis performance and usability.
<table><tr><th>nMPK</th><th>MPK</th><th>Difference</th></tr><tr><td>555.3</td><td>732.8</td><td>30.4%</td></tr></table></td><td>++</td></tr>
<tr><td></td><td></td><td>A higher PEQ score was correlated with higher sedentary time with nMPK (r=0.57)</td><td>++</td></tr>
</table>

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

* Results are displayed as mean or mean ± standard deviation if not specified otherwise.

Pearson correlation coefficients (r):

direction - Positive (0 and +1), negative (0 and -1), no correlation (r=0);

magnitude - Weak (<0.3), Moderate (0.3-0.5), Strong (>0.5).

Author's Conclusion

„Provision of an MPK improved self-reported mobility, function, and prosthetic satisfaction. This highlights an improved outcome after MPK provision within a relatively short period of follow-up observed in this study. There was a large degree of intra- and intersubject variability in the activity-based parameters monitored over a 7-day period, pre- and post-MPK provision. Future studies are needed to explore the role of activity monitoring and step count in assessing outcomes in individuals with lower limb loss. This should include patient-perceived benefit and an observed change in function." (Caggiari, 2025)

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