

Comparison of nonmicroprocessor knee mechanism versus C-Leg on Prosthesis Evaluation Questionnaire, stumbles, falls, walking tests, stair descent, and knee preference

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Abstract

This study compared subjects' performance with a nonmicroprocessor knee mechanism (NMKM) versus a C-Leg on nine clinically repeatable evaluative measures. We recorded data on subjects' performance while they used an accommodated NMKM and, following a 90-day accommodation period, the C-Leg in a convenience sample of 19 transfemoral (TF) amputees (mean age 51 +/- 19) from an outpatient prosthetic clinic. We found that use of the C-Leg improved function in all outcomes: (1) Prosthesis Evaluation Questionnaire scores increased 20% ($p = 0.007$), (2) stumbles decreased 59% ($p = 0.006$), (3) falls decreased 64% ($p = 0.03$), (4) 75 m self-selected walking speed on even terrain improved 15% ($p = 0.03$), (5) 75 m fastest possible walking speed (FPWS) on even terrain improved 12% ($p = 0.005$), (6) 38 m FPWS on uneven terrain improved 21% ($p < 0.001$), (7) 6 m FPWS on even terrain improved 17% ($p = 0.001$), (8) Montreal Rehabilitation Performance Profile Performance Composite Scores for stair descent increased for 12 subjects, and (9) the C-Leg was preferred over the NMKM by 14 subjects. Four limited community ambulators (Medicare Functional Classification Level [MFCL] K2) increased their ambulatory functional level to unlimited community ambulation (MFCL K3). Objective evaluative clinical measures are vital for justifying the medical necessity of knee mechanisms for TF amputees. Use of the C-Leg improves performance and quality of life and can increase MFCL and community ambulation level.

PEQ= Prosthesis Evaluation Questionnaire, is a survey administered by researchers and clinicians to people with limb loss. This survey instrument is a way for researchers to distinguish and grade the subjective opinion of an amputee and their thoughts about their prosthesis. It asks questions like, how many times do you stumble and fall, and can you walk in close spaces and on slippery surfaces. The amputees wearing a C-Leg showed a 20% improvement over mechanical knees.

Stumbles are defined as any interruption in walking or standing that leads to an incidence that is almost a fall, or a close call to a fall. The average subject (amputee) in this study stumbled 7 times with a mechanical knee and 3 times with a C-Leg, or computer controlled knee. The amputees wearing a C-Leg showed a 59% improvement over mechanical knees.

Falls are any event that makes a person with limb loss fall to the ground whether or not they are injured or not. The average subject (amputee) in this study fell 3 times with a mechanical knee and 1 time with a C-Leg, or computer controlled knee. The amputees wearing a C-Leg showed a 64% improvement over mechanical knees.

SSWS, Self selected walking speed. When amputees were asked to walk at a speed they were comfortable with for 75 meters, they walked faster with the C-Leg. The amputees wearing a C-Leg showed a 15% improvement over mechanical knees.

FPWS, Fastest possible walking speed on even ground. When amputees were asked to walk as fast as they were comfortable with for 75 meters, they walked faster with the C-Leg. The amputees wearing a C-Leg showed a 12% improvement over mechanical knees.

FPWS, Fastest possible walking speed on uneven ground that was comprised of gravel, grass, and dirt. When amputees were asked to walk as fast as they were comfortable with for 38 meters, they walked faster with the C-Leg. The amputees wearing a C-Leg showed a 21% improvement over mechanical knees.

FPWS, Fastest possible walking speed. When amputees were asked to walk as fast as they were comfortable with for 6 meters, they walked faster with the C-Leg. 6 meters is approximately the distance of two lanes of traffic. The researchers wanted to find out how the amputees would perform in a fight or flight situation. The amputees wearing a C-Leg showed a 17% improvement over mechanical knees.

Table 3.

Results of *t*-tests (mean \pm standard deviation) and percent change on performance evaluative measures for C-Leg vs nonmicroprocessor knee mechanism (NMKM) (*N* = 19).

Measure	NMKM	C-Leg	<i>p</i> -Value	% Change
PEQ	942.3 \pm 269.3	1,184.1 \pm 243.1	0.007*	20
Stumbles (No.)	7 \pm 6	3 \pm 4	0.006*	59
Falls (No.)	3 \pm 3	1 \pm 2	0.03†	64
SSWS 75 m (s)	101.3 \pm 47.8	86.4 \pm 32.8	0.03†	15
FPWS 75 m (s)	81.4 \pm 33.6	71.2 \pm 26.1	0.005*	12
FPWS 38 m Uneven Terrain (s)	55.9 \pm 22.0	44.2 \pm 16.4	<0.001*	21
FPWS 6 m (s)	6.5 \pm 2.6	5.4 \pm 2.2	0.001*	17

*Significant at $p \leq 0.01$.

†Significant at $p \leq 0.05$.

PEQ = Prosthesis Evaluation Questionnaire, SSWS = self-selected walking speed, FPWS = fastest possible walking speed.

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