

Reference

Michael Devlin, MD, FRCPC¹, Lynne B. Sinclair, MA², Deborah Colman, MA(Ed), Janet Parsons, MSc^{2,3}, Henry Nizio, CP(c)⁴, Janet E. Campbell, MSCP⁴

Patient Preference and Gait Efficiency in a Geriatric Population With Transfemoral Amputation Using a Free-Swinging Versus a Locked Prosthetic Knee Joint

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Products

Friction Brake Knee (3R15) vs. Locked Knee (3R17)

Major Findings

With a weight-activated friction-brake knee (WASB; “free-swinging knee”) (3R15) compared to a locked knee joint (3R17):

→ **Significantly increased 2-minute walk distance in geriatric patients using the locked knee 3R17 (+21.2%, p = 0.001)**

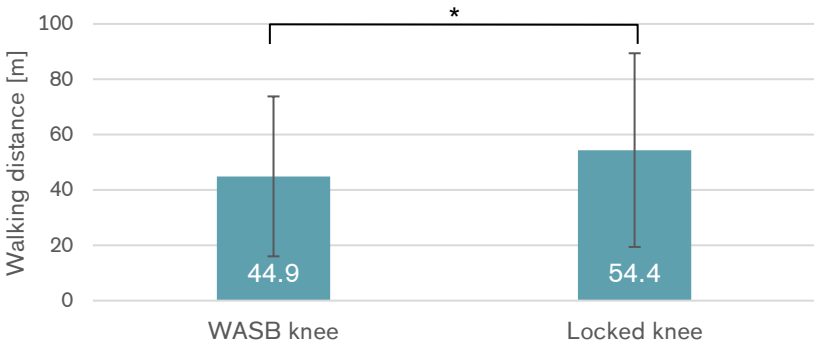


Figure 1. 2-minute walking distance for WASB knee (3R15) versus the locked knee 3R17. * indicates a significant difference p=0.001.

→ **79% (11 out of 14) of the geriatric patients preferred the locked knee**

- Primarily reported were greater safety, less need to concentrate while walking, and better stair and outdoor walking
- Younger participants preferred the WASB knee 3R15 over the locked knee 3R17 although they walked significantly farther in the 2-minute walk test with the locked knee (+20.2%, p = 0.03)

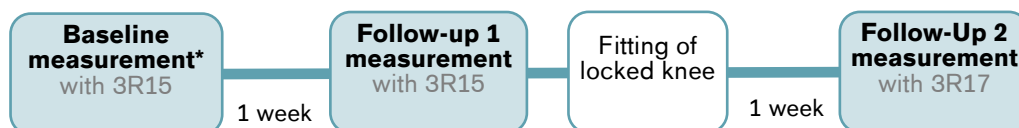
→ **Prosthetic use in daily life was greater with the locked knee 3R17, indicated by higher Houghton Scale scores (+1.2 points or +18.2%, p = 0.01)**

Population

Subjects:	14 subjects (11 male, 3 female)
Amputation level:	unilateral transfemoral
Previous prosthesis:	free-swinging (<u>weight-activated friction-brake</u>) knee
Amputation causes:	vascular causes
Mean age:	69.5 ± 6.14 years (range: 61-80 years)
Mean time since amputation:	n.r.
MFCL:	(geriatric patients)

Study Design

Before-After trial:



*Baseline measurement (approximately 3 months of use): 2-minute walking test, demographic data, Houghton scale

**Follow-up 1 (when their walking performance in the 2-minute walk test stabilized): 2-minute walk test, preference questionnaires

***Follow-up 2: 2-minute walk test, preference questionnaires

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 (Mean ± SD)	Sig. ^{a,b}										
Level walking	2-minute walking distance [m]	All 14 participants walked significantly farther (+9.5m, 21.2%) with the locked knee than the WASB knee.	++										
		<table><tr><th>WASB knee (3R15)</th><th>Locked knee (3R17)</th></tr><tr><td>44.9 ± 28.9</td><td>54.4 ± 35</td></tr></table>	WASB knee (3R15)	Locked knee (3R17)	44.9 ± 28.9	54.4 ± 35							
		WASB knee (3R15)	Locked knee (3R17)										
44.9 ± 28.9	54.4 ± 35												
Activity, Mobility, Activities of Daily Living (ADLs)	Houghton-Score (prosthetic use)	Scores indicate that prosthetic use was significantly greater with the locked knee (+1.2 points, +18.2%)	++										
		<table><tr><th>WASB knee (3R15)</th><th>Locked knee (3R17)</th></tr><tr><td>6.6 ± 2.5</td><td>7.8 ± 2.2</td></tr></table>	WASB knee (3R15)	Locked knee (3R17)	6.6 ± 2.5	7.8 ± 2.2							
		WASB knee (3R15)	Locked knee (3R17)										
		6.6 ± 2.5	7.8 ± 2.2										
		No statistically significant difference in prosthetic use when using the preferred knee:	0										
<table><tr><th>Prosthesis</th><th>Houghton score</th></tr><tr><td>Preference: WASB knee (3R15) (n=3)</td><td>8.0 ± 1.0</td></tr><tr><td>Preference: Locked knee (3R17) (n=11)</td><td>6.3 ± 2.8</td></tr></table>	Prosthesis	Houghton score	Preference: WASB knee (3R15) (n=3)	8.0 ± 1.0	Preference: Locked knee (3R17) (n=11)	6.3 ± 2.8							
Prosthesis	Houghton score												
Preference: WASB knee (3R15) (n=3)	8.0 ± 1.0												
Preference: Locked knee (3R17) (n=11)	6.3 ± 2.8												
Preference, Satisfaction, Quality of Life (QoL)	Knee joint Preference	11 of 14 patients (79%) preferred the locked knee as their definitive prosthesis (3 patients preferred the WASB knee).	n.a.										
		Patients who preferred the WASB knee (3R15) were:											
		- significantly younger	--										
		- walked significantly farther with it	++										
		However, both groups walked significantly farther with the locked knee (3R17) than the WASB knee .	++										
		<table><tr><th>Prosthesis</th><th>Age [years]</th><th>3R15 walking distance [m]</th><th>3R17 walking distance [m]</th></tr><tr><td>Preference 3R15 (n=3)</td><td>63 ± 3.5</td><td>85.2 ± 30.7</td><td>106.8 ± 38.2</td></tr><tr><td>Preference 3R17 (n=11)</td><td>71.3 ± 5.5</td><td>33.9 ± 16.8</td><td>n.r. (6.2 m greater than with 3R15)</td></tr></table>	Prosthesis	Age [years]	3R15 walking distance [m]	3R17 walking distance [m]	Preference 3R15 (n=3)	63 ± 3.5	85.2 ± 30.7	106.8 ± 38.2	Preference 3R17 (n=11)	71.3 ± 5.5	33.9 ± 16.8
Prosthesis	Age [years]	3R15 walking distance [m]	3R17 walking distance [m]										
Preference 3R15 (n=3)	63 ± 3.5	85.2 ± 30.7	106.8 ± 38.2										
Preference 3R17 (n=11)	71.3 ± 5.5	33.9 ± 16.8	n.r. (6.2 m greater than with 3R15)										

Category	Outcomes	Results (Mean ± SD)	Sig. ^{a,b}
	Open ended feedback	<u>Reasons for preference of locked knee (3R17):</u> Feels more secure, reduced cognitive load while walking, improved ability to climb stairs and walk outdoors <u>Reasons for preference of WASB knee (3R15):</u> Feels more natural	
	Likert score	<u>10 patients:</u> locked knee (3R17) was "much better" <u>1 patient:</u> locked knee (3R17) was "somewhat better" <u>3 patients:</u> WASB knee (3R15) was "much preferred"	n.a.

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

^b Effect sizes classified by authors as small (< 0.3), moderate (> 0.3 and < 0.5) or large (> 0.5)

Author's Conclusion

"Use of a locked knee joint was believed to be superior to a free-swinging knee by most of the geriatric individuals with dysvascular transfemoral amputation in our study, as indicated by their preference for this component. This group walked faster with a locked knee, regardless of which knee type they preferred. Persons who preferred the locked knee also reported a greater degree of prosthetic usage with the locked knee. Those who preferred the free-swinging knee were among the fastest walkers in the group. However, the small sample size of the group choosing the free-swinging knee makes further analysis in this group problematic. The speed of walking may reflect different factors, such as confidence and cardiorespiratory reserve, which may indicate that there is a threshold of walking speed, above which a free-swinging knee is preferred. Further research is needed to answer this question. Based on our findings, we recommend that geriatric patients with transfemoral amputation be fitted initially with locking knees, with the possibility of changing to a free-swinging knee if they prove to be fast walkers. If locked knee joints were used as the initial component, the patients could resume life in the community much sooner because it takes less time to learn how to use an above-knee prosthesis with a locked knee than to learn how to use a free-swinging knee. Society would benefit also because time spent in rehabilitation would be shorter, which would lower overall costs. (There is no significant difference in the cost of the 2 different knee joints.) Traditionally, the locked knee joint has been provided when a patient has not been able to control the free-swinging knee; results of this study should encourage rehabilitation professionals to assess, and perhaps change, their attitudes toward prosthetic components and to focus on providing appropriate devices to the geriatric population according to patient preference and performance." (Devlin et al., 2002)

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