Reference

Bell EM, Pruziner AL, Wilken JM, Wolf EJ.

Department of Rehabilitation, Walter Reed National Military Medical Center, Bethesda, MD, 20889, USA.

Performance of conventional and X2® prosthetic knees during slope descent.

Clin Biomech, 2016; 33: 26–31.

Products

Genium X2®

Major Findings

With **Genium X2®** (X2) compared to

- Mechanical knee (**MECH**) (Total Knee & Mauch, Össur) and
- Standard microprocessor controlled knee (**MPK**) (C-Leg, Otto Bock & Rheo Knee, Össur):

→ Walking speed is faster by 9.6% (+0.1 m/s) compared to MPK.

→ Step length is longer with X2 by 1.6-16.9% and leads to a more harmonized movement in slope descent.

→ Through the stance flexion resistance, walking with the X2 was more comparable to able-bodied individuals.

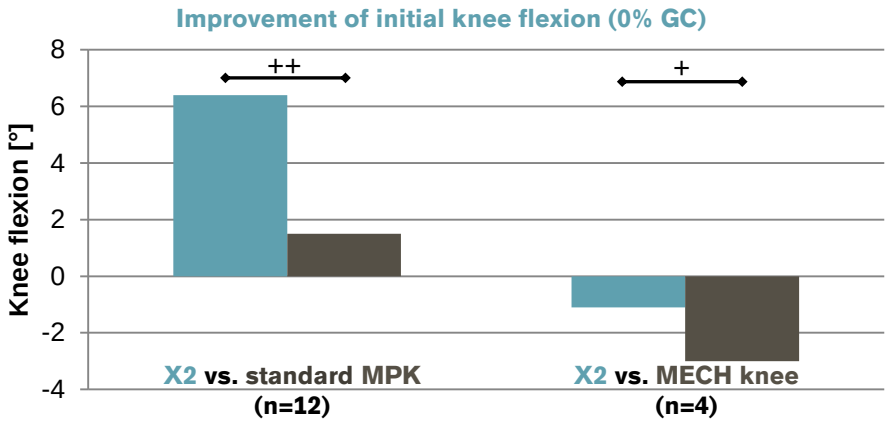
Initial knee flexion (0% GC): 326.7% more flexion
Max knee swing flexion (50-100% GC): 21.2% more flexion

→ A heightened use of the intact limb for support in descent could be indicated by the significant increase of the max. support moment flexion with X2 compared to MPK:

0% GC: 26.3% higher
35-75% GC: 21.2% higher

→ With X2, the prosthetic limb was utilized and loaded more normative. Therfore, the first vertical impact maximum (0-30%) increased up to 13.2%.

Please note: The percentage differences were calculated between the published Median values.

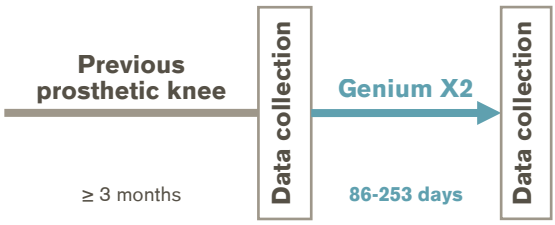


Population

Subjects:	21 unilateral, transfemoral amputees	
Previous prosthetic knee:	Mechanical knee (n=8)	→ Total Knee (Össur) → Mauch (Össur)
	Standard MPK (n=13)	→ C-Leg (Otto Bock) → Rheo Knee (Össur)
Amputation causes:	Trauma	
Mean age:	32.7 yrs (± 5.3 yrs)	
Time since amputation:	≥ 2 years	
MFCL:	K4	

Study Design

Interventional, pre- to post-test design:



Use of handrails influenced what data were available for biomechanical analysis. As such, data from participants who self-selected to use handrails for support were not included in temporal-spatial, kinematic, or kinetic analyses.

	Temporal-spatial	Kinematic	Kinetic
MECH	n=4	n=4	n=3
MPK	n=12	n=12	n=11

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 Genium X2	
Ramps, Hills	Temporal-spatial	**Walking speed is faster:**	
		X2 vs. MPK **9.6% faster** **++**	X2 vs. MECH 8.2% faster +
		Step length is longer with X2:	
		X2 vs. MPK **16.9% longer** **++**	X2 vs. MECH 1.6% longer +
		No significant differences were found for stance time.	
	Kinematic	**The initial knee flexion (0% GC) increased with X2 compared to MPK (significantly) and MECH:**	
		X2 vs. MPK **326.7% higher** **++**	X2 vs. MECH 63.3% higher +

Category	Outcomes	Results for Genium X2	
		The max. knee swing flexion (50-100% GC) increased:	
		X2 vs. MPK **21.2% higher** **++**	X2 vs. MECH 8.83% higher +
		No significant differences were found for: • Ankle excursion (0-100% GC) • Hip excursion (0-100% GC)	
	Kinetic	**The max. support moment (0-30% GC) increased with X2 compared to the previous knee:**	
		X2 vs. MPK **26.3% higher** **++**	X2 vs. MECH 240.6% higher +
		The max. support moment (35-75% GC) increased:	
		X2 vs. MPK **21.2% higher** **++**	X2 vs. MECH 147.5% higher +
		Due to more prosthetic limb utilization and normative loading, the first vertical impact maximum (0-30%) increased:	
		X2 vs. MPK **13.2% higher** **++**	X2 vs. MECH 12.3% higher +
		No significant differences were found for: • Max. braking force (0-30%) • Max. propulsive force (35-75%) • Second vertical impact maximum (35-75%)	

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

Author's Conclusion

"The aim of the current study was to determine if use of the X2® improves overall slope descent mechanics by assessing self-selected technique of decent, and subsequent changes in temporal-spatial outcomes and joint mechanics. Although this analysis finds normalization of some temporal-spatial outcomes and joint mechanics were likely achieved due to the use of stance flexion resistance with the X2® device allowing for improved control lowering the body when both leading and trailing, some values continued to deviate from those of able-bodied individuals. Nevertheless, decreased reliance on handrail use as MECH users descended in the X2® suggest improved function and perhaps greater confidence in the device possibly reducing the risk of falling. Furthermore, overall reductions in intact limb loading and more symmetric loading at impact could indicate more normative loading patterns and a possible reduction of intact limb overuse during downslope walking. Reducing compensatory gait strategies during slope descent, perhaps through use of the X2®, could thus play a role in mitigating longer-term overuse injuries commonly associated with TFA." (Bell et al., 2016)