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the human empowerment company

Importance of Properly Fit TF Prosthetics & Microprocessor Knees

Scott Sabolich, CP, LP
Senior Director Ottobock Patient Care

12-November-2025

Scott Sabolich, CP, LP

Senior Director, Ottobock Patient Care

- **Certified & Licensed Prosthetist since 1995, in the field since 1989 and before**
- **Specializes in difficult to fit TF & challenging cases**
- **Instructor of the patented Sabolich Socket through Ottobock**
- **In 1999, opened Scott Sabolich Prosthetics and Research in OKC as a destination facility with a state-of-the-art Prosthetic Patient care center**
- **In 2012, he opened a second facility to extend exceptional care and expertise in Dallas TX**
- **In 2019, Scott Sabolich Prosthetics and Research joined Ottobock, a global leader in prosthetic and orthotic technology as Ottobock entered into Patient Care**

50+ Clinics Across the U.S.

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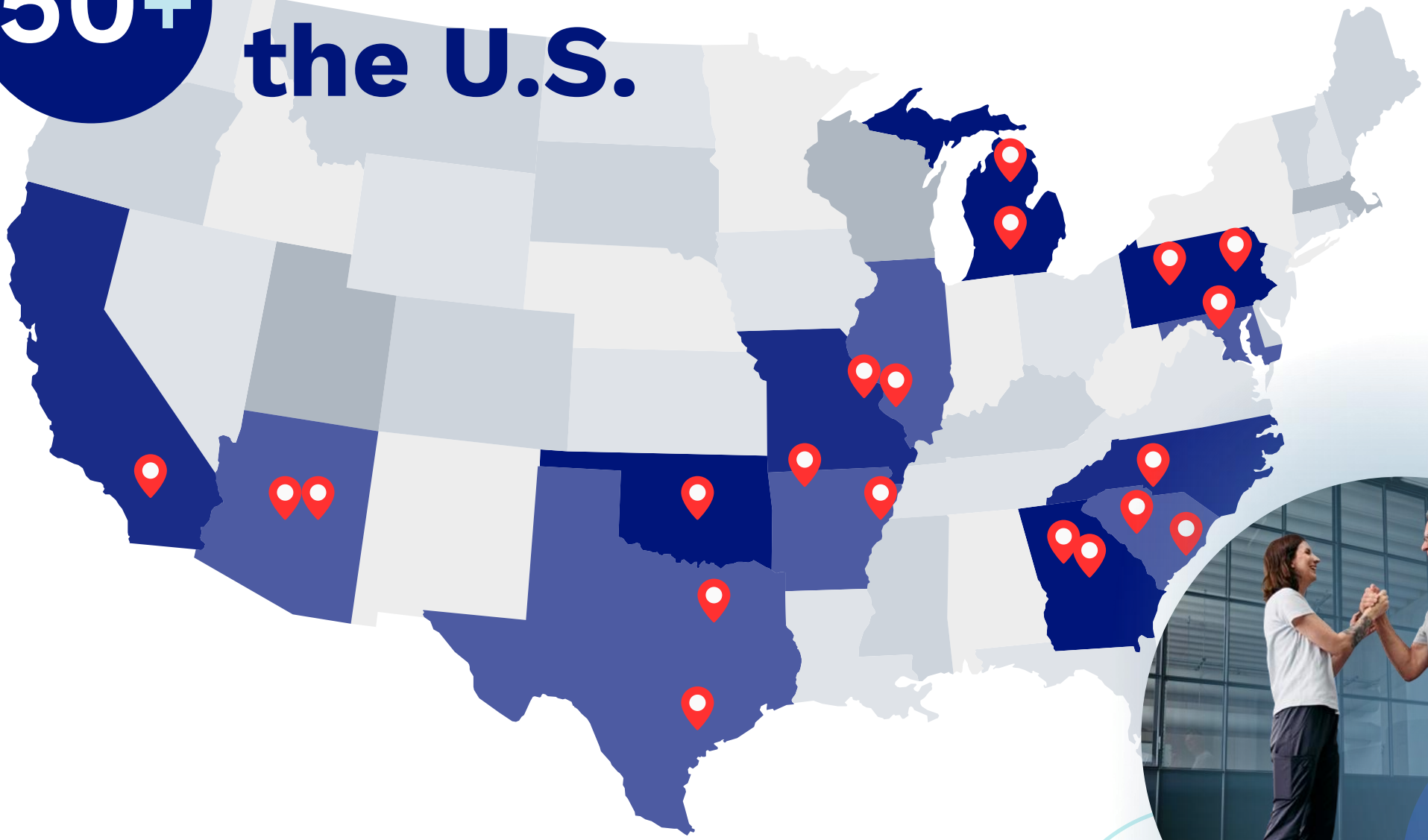
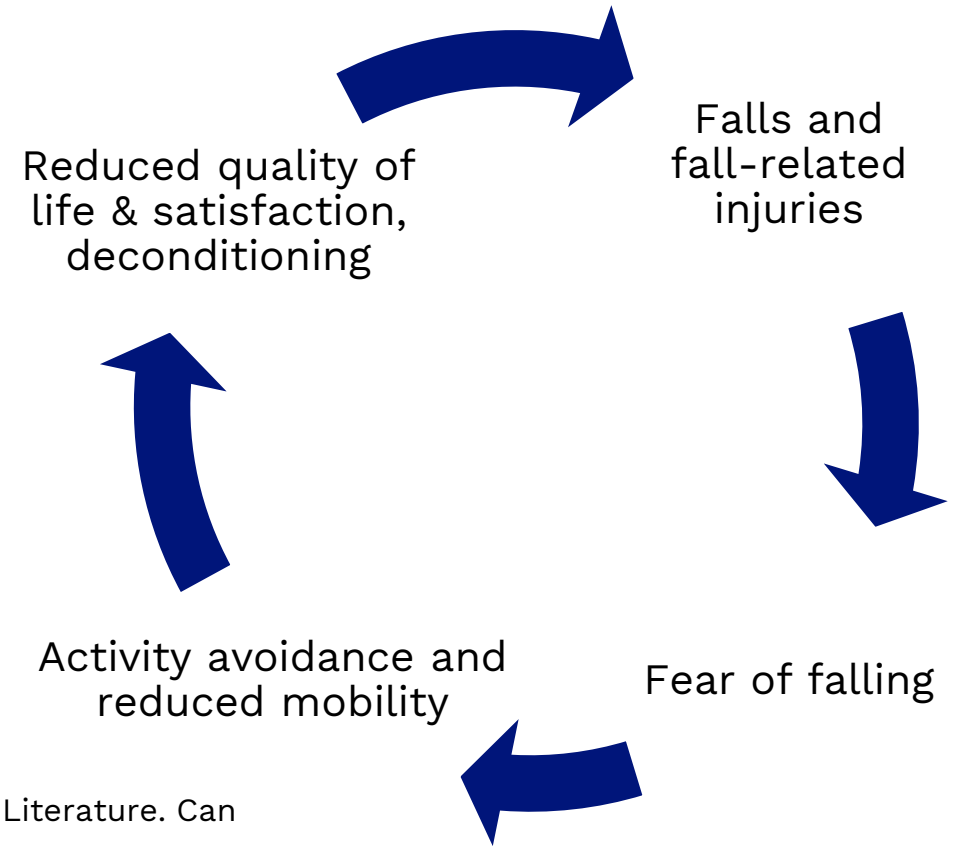


The vicious cycle of falling in TF prosthetics



MacKay et al. Fear of Falling in Older Adults: A Scoping Review of Recent Literature. Can Geriatr J. 2021;24(4):379-394.

The vicious cycle of falling in TF prosthetics

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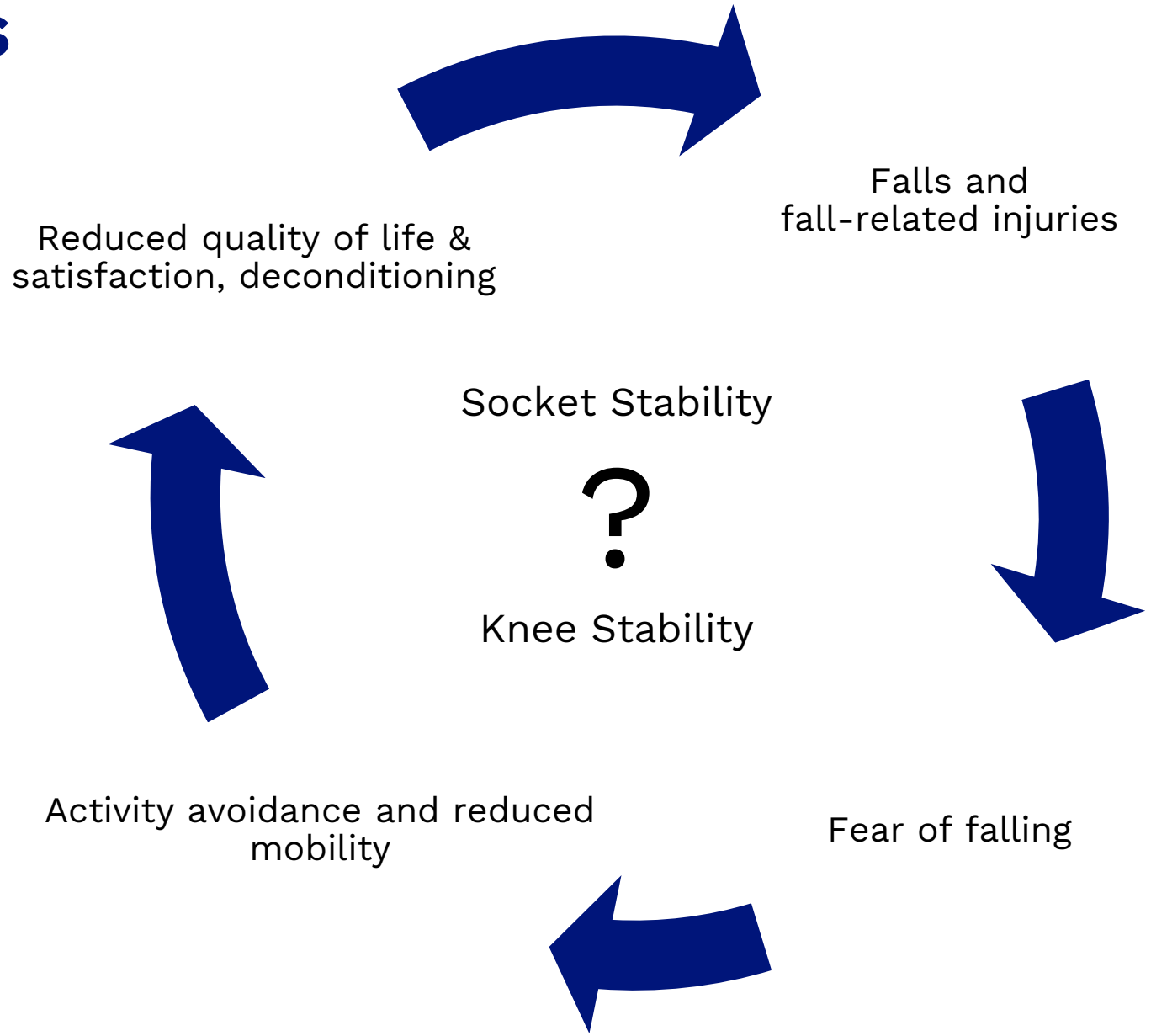

Socket Stability (Handcast)

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Socket Stability (Pre Fab)

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Most Popular Adjustable Prefab Sockets

- Ottobock Varos
- Martin Bionics
- LIM Innovations
- Ifit Immediate Fit
- Click Medical Revo Design

Socket Stability

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Insert Content on Gait Deviations

Socket Stability

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Insert Content on Socket Fittings

Socket Stability

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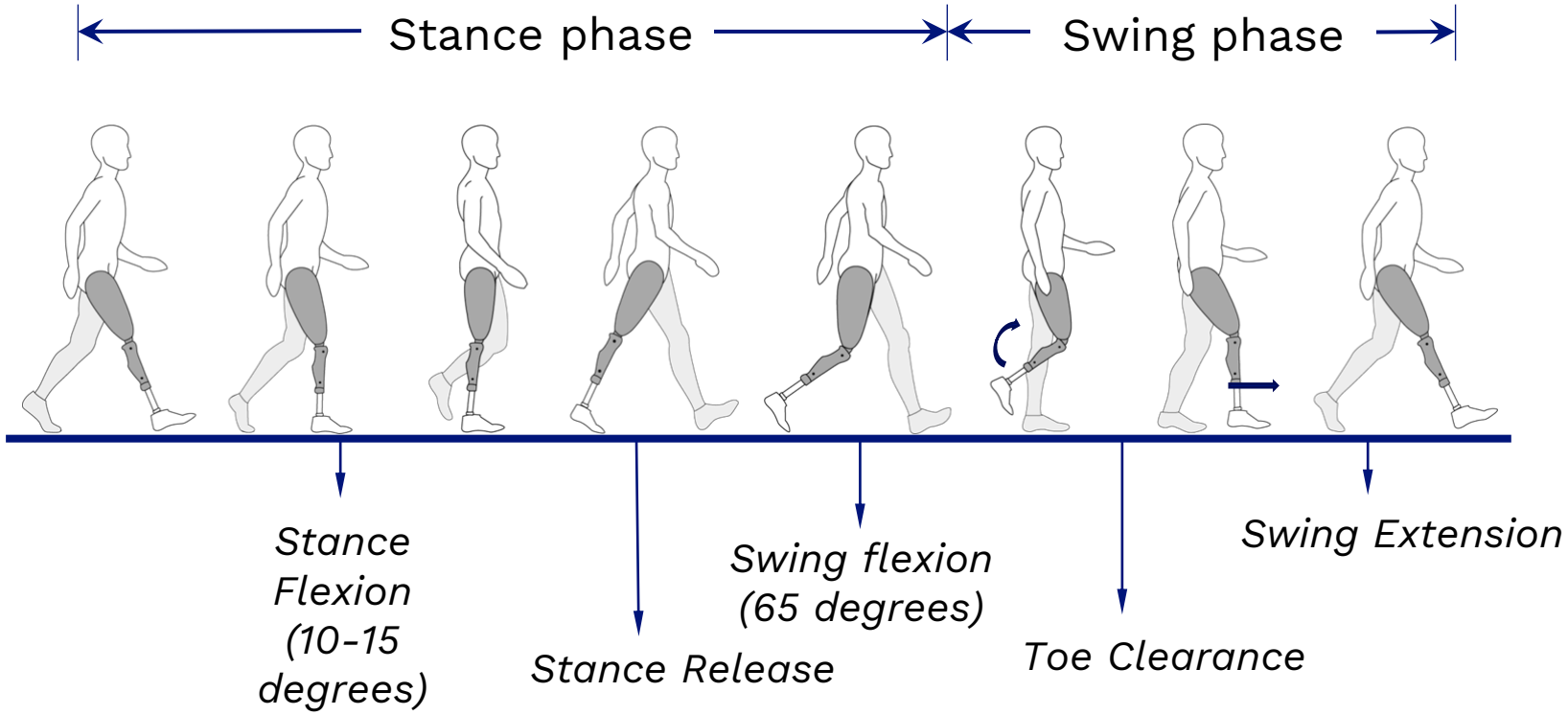
Knee Stability



Stumble recovery

Impact of MPKs (and Sockets) on Falls Research

The Prevalence and Risk Factors of Falling and Fear of Falling Among Lower Extremity Amputees

William C. Miller, PhD, MSc, OT, Mark Speechley, PhD, Barry Deathe, MD

Pre-MPK era data (2001)!

- **52% fell in previous 12 months (19% sought medical attention)**
- **TF 2.78x more likely to fall vs. TT**

Impact of Vascular Disease, Amputation Level, and the Mismatch Between Balance Ability and Balance Confidence in a Cross-Sectional Study of the Likelihood of Falls Among People With Limb Loss

Christopher Kevin Wong, PT, PhD, OCS, and Stanford T. Chihuri, MPH

Post-MPK era data (2018/2019)!

- **66% fell in previous 12 months**
- **After adjusting for vascular comorbidity and balance, TF less likely to fall vs. TT**
- **TT's 2.32x more likely to have a fall-related injury vs. TF (Chihuri and Wong 2018)**

With the advent of MPK adoption for AK amputees:

- TF level alone no longer associated with higher fall risk vs TT
- TF amputation associated with a lower ***fall injury*** risk vs TT

MPKs and Cognitive Load

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Where are the eyes looking?

Stair descent & multi-tasking

Courtesy of Dale Berry, CPO

Microprocessor Knees

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Lower Mobility ⟷ **Higher Mobility**

Kenevo

K2 level solution
Lightest and shortest MPK
Progresses with the user

C-Leg 4

K3 level solution
Most studied knee in the world
Fits all daily activities

Rheo Knee

Low to Moderate Impact
Dependable swing initiation
Weatherproof

Genium X4

K4 level solution
Advanced gait algorithms
Rugged for impact activity

Default Stance

Default Swing

Default Stance

Kenevo

ottobock.

- ✓ Activity Modes
- ✓ Supported sitting/standing
- ✓ Wheelchair function
- ✓ Donning function
- ✓ Bicycle function
- ✓ Battery life: 1 day

Kenevo

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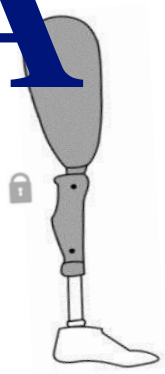
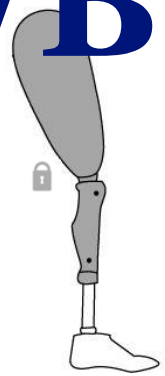
Activity Modes

A



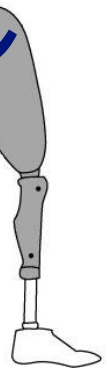
Functions as a locked knee

B/B+



Functions as a weight-activated knee

C

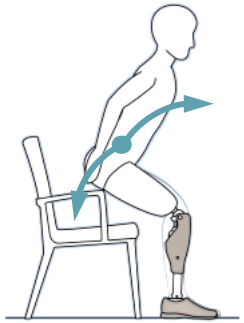


Functions as a yielding knee

Activity modes are set by the prosthetist according to the end-user's functional abilities. The modes can be changed when the end-user progresses through the recovery process.

Basic Functions

Donning Function (A/B/B+)



Supported sitting down & standing up

Sitting Function

Wheelchair Function

Stance Function (C)

Bicycle Function

These underlying functions are designed with the lower mobility individual in mind. Their purpose is safety and stability during functional activities.

C-Leg 4

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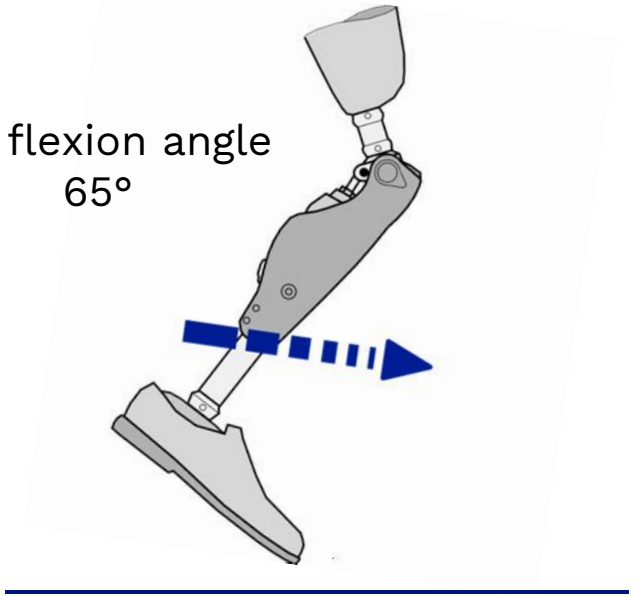
- ✓ Basic Mode
- ✓ Stumble Recovery Plus
- ✓ Stance function
- ✓ Training feedback
- ✓ MyModes (5)
- ✓ Battery life: 2 days

C-Leg 4

Basic Mode

Resistance to knee flexion

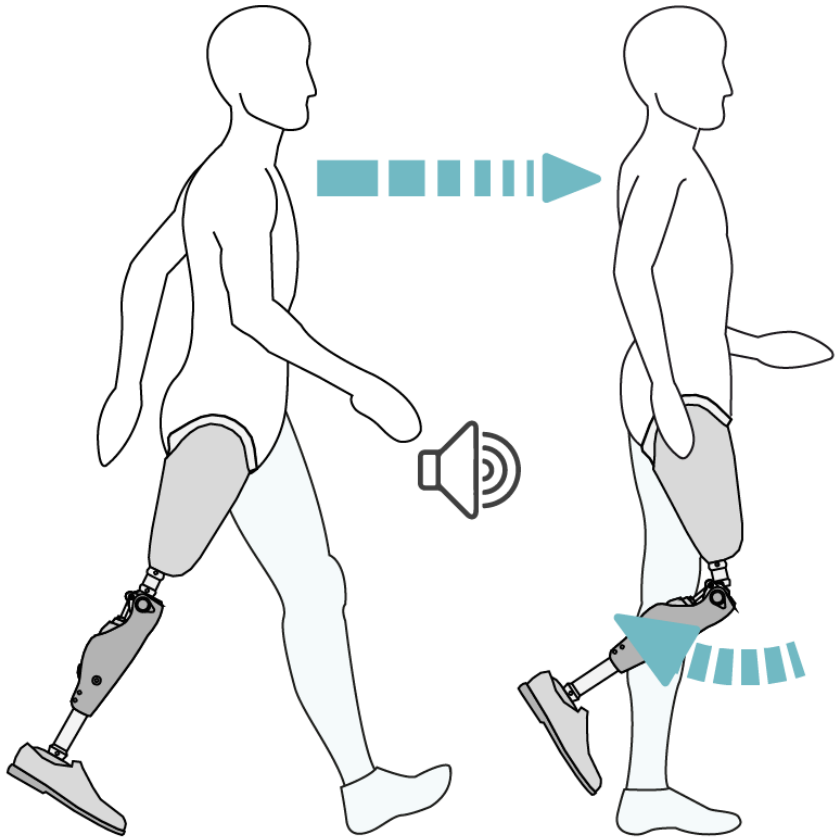
Knee flexion angle 65°



Two basic adjustments are required: stance flexion resistance and the swing flexion angle. In addition, two MyModes can be set for specific activities.

C-Leg 4

Training function



An acoustic feedback signal is emitted when stance release is successfully triggered

(User enabled)

C-Leg 4

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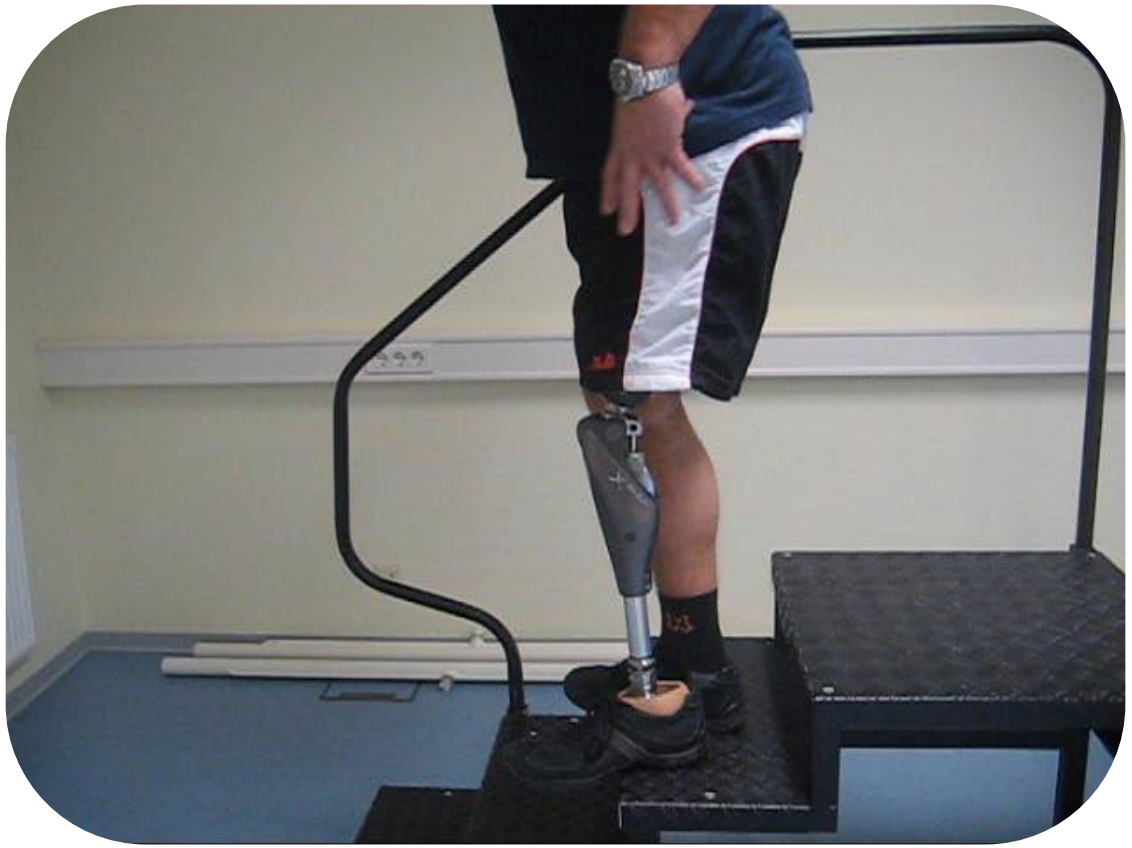
Stance Function (intuitive or deliberate)

- ✓ Stability on uneven surfaces
- ✓ Rest for the sound limb
- ✓ Positioning for tasks



**Can hamper training efforts if not trained*

Rheo / Rheo XC

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- ✓ Mimicks natural gait
- ✓ Effortless Swing Initiation
- ✓ Weight activated stance
- ✓ Weather proof
- ✓ Manual extension lock
- ✓ Step over and step backwards features
- ✓ XC Stair over stair and walk to run

Genium X4

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- ✓ Start to Walk
- ✓ PreFlex
- ✓ Added support on ramps
- ✓ Optimized slope ascent
- ✓ Stair and obstacles
- ✓ Intuitive cycling
- ✓ Dynamic backward movement
- ✓ Battery life: 5 days

Genium X4 Features

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Start-to-walk

On Set value

This function makes it easier to go from standing to walking and to walk in tight spaces.

The user can turn this function on and off in the Cockpit app.

More information

PreFlex

On Set value

This function facilitates the initiation of stance phase flexion and allows for more harmonious forward movement.

The user can turn this function on and off in the Cockpit app.

More information

Dynamic backward movement

20

Minimum Maximum

15 30

The user can adjust this value between 15 and 30 in the Cockpit app.

This function enables dynamic backward movement due to increased flexion resistance.

More information

Intuitive cycling

On Set value

This function enables automatic switching into and out of cycling mode.

The user can turn this function on and off in the Cockpit app.

More information

Genium X4 Features

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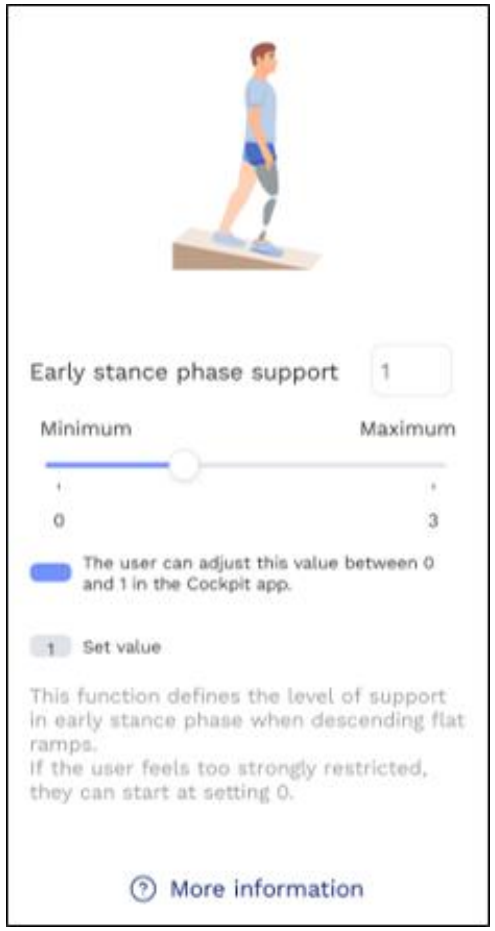

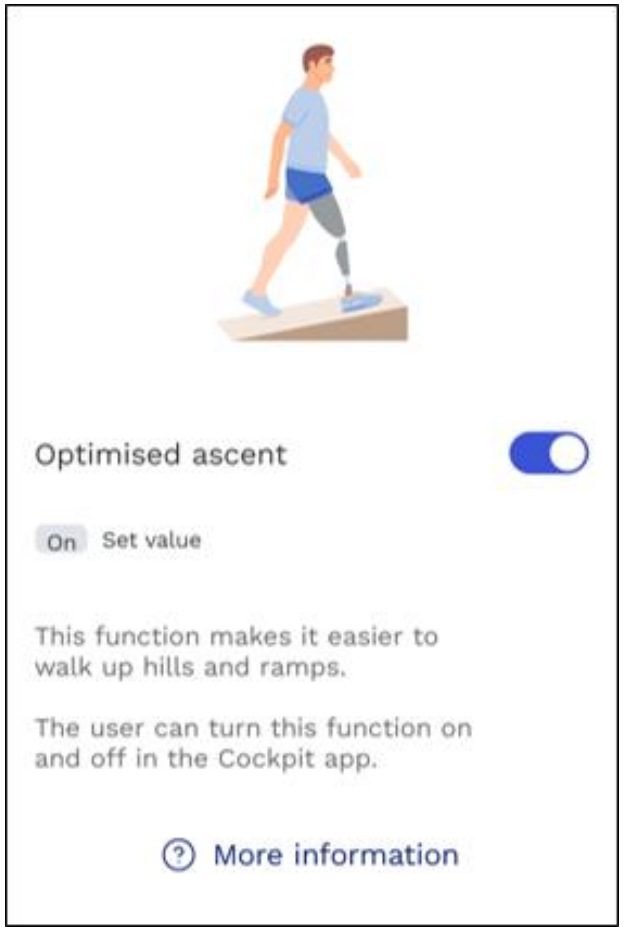

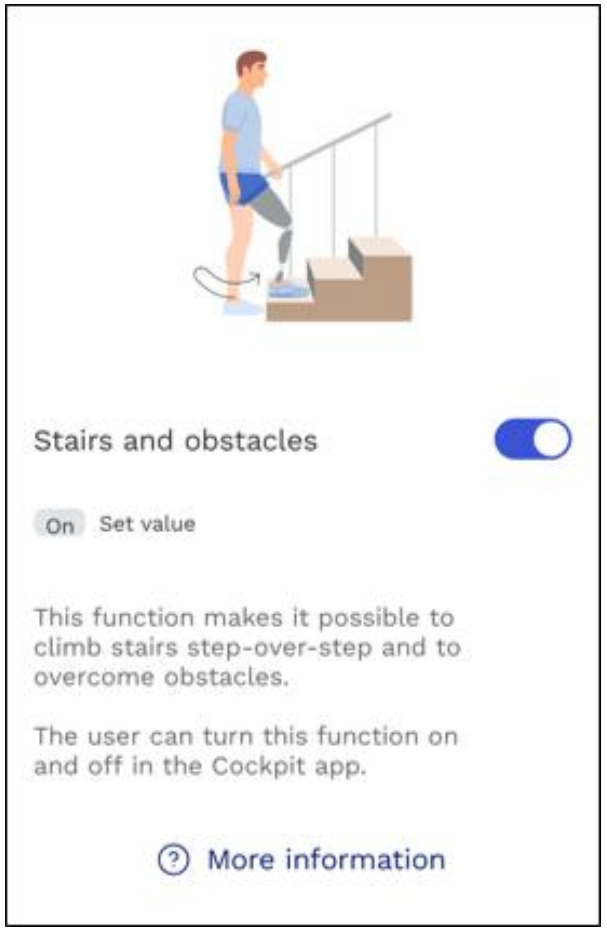

Water & MPKs

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Moisture protection for the electronics

IP 22

Dripping water

IP 68

Continuous water immersion
3m water up to 1 hour

IP 68

Continuous water immersion
3m water up to 1 hour
Corrosion-resistant

ASCENT K2 Study Findings

Randomized study including over 100 subjects

	MPK	NMPK
Fear of falling:	**Reduced**	**No change**
Falls:	**1.3**	**2.7**
Near-Falls:	**1.7**	**5.7**
Walking speed:	**Faster**	**No change**
Fall risk (TUG):	**Lower**	**No change**
Fall impact:	**-2.21 ± 1.30**	**No change**
Quality of Life:	**No change**	**Decline**

Green: significant improvement or difference

Red: significant decline

*Fear of falling activity avoidance; **Consequences of falling; ***Quality of life

Conclusion

~~“Why would this person benefit from an MPK?”~~

“Why would an MPK not be appropriate for this person?”

References

MacKay S, Ebert P, Harbidge C, Hogan DB. Fear of Falling in Older Adults: A Scoping Review of Recent Literature. Can Geriatr J. 2021;24(4):379-394. Published 2021 Dec 1. doi:10.5770/cgj.24.521

Miller WC, Speechley M, Deathe B. The prevalence and risk factors of falling and fear of falling among lower extremity amputees. Arch Phys Med Rehabil. 2001;82(8):1031-1037. doi:10.1053/apmr.2001.24295

Blumentritt S: Biomechanische Aspekte zur Indikation von Prothesenkniegelenken. [Biomechanical aspects of the indications of prosthetic knee joints.] Orthopädie-Technik. 2004;55(6):508-524. Article in German.

Köhler TM, Bellmann M, Blumentritt S. Polycentric exoprosthetic knee joints – extent of shortening during swing phase. Can Prosthet Orthot J 2020;Volume, Issue1, No.5. https://doi.org/10.33137/cpoj.v3i1.33768

Wong CK, Chihuri ST. Impact of Vascular Disease, Amputation Level, and the Mismatch Between Balance Ability and Balance Confidence in a Cross-Sectional Study of the Likelihood of Falls Among People With Limb Loss: Perception Versus Reality. Am J Phys Med Rehabil. 2019;98(2):130-135. doi:10.1097/PHM.0000000000001034

Hahn A, Bueschges S, Prager M, Kannenberg A. The effect of microprocessor controlled exo-prosthetic knees on limited commClinical Researchy ambulators: systematic review and meta-analysis. Disabil Rehabil 2021 Oct 25:1-19. Download

Highsmith MJ, Kahle JT, Bongiorni DR, Sutton BS, Groer S, Kaufman KR. Safety, energy efficiency, and cost efficacy of the C-leg for transfemoral amputees. Prosth Orthot Int 2010;34(4):362-377. Download (open access)

Hafner BJ, Smith DG. Differences in function and safety between Medicare Functional Classification Level-2 and -3 transfemoral amputees and influence of prosthetic knee joint control. J Rehabil Res Dev 2009;46(3):417-434.

Blumentritt S, Schmalz T, Jarasch R. The safety of C-leg: Biomechanical tests. J Prosthet Orthot 2009;21(1):2-17. Download (open access for AAOP members only)

Kahle JT, Highsmith MJ, Hubbard SL. Comparison of Non-microprocessor Knee Mechanism versus C-Leg on Prosthesis Evaluation Questionnaire, Stumbles, Falls, Walking Tests, Stair Descent, and Knee Preference; J Rehabil Res Dev 2008;45(1):1-14.

Hafner BJ, Willingham LL, Buell NC, Allyn KJ, Smith DG: Evaluation of Function, Performance, and Preference as Transfemoral Amputees Transition from Mechanical to Microprocessor Control of the Prosthetic Knee. Arch Phys Med Rehabil 2007;88(2):207-217. Download (available for purchase)

Campbell JH, Stevens PM, Wurdeman SR. OASIS I. Retrospective analysis of four different microprocessor knee types. Journal Rehabil Assist Technol Eng 2020;7: 1-10. Download (open access)

Highsmith MJ, Kahle JT, Miro RM, Mengelkoch, MJ. Ramp descent performance with the C-leg and interrater reliability of the Hill Assessment Index. Prosthet Orthot Int 2013;37(5):362-368. Download (open access)

Seymour R, Engbretson B, Kott K, Ordway N, Brooks G, Crannell J, Hickernell E, Wheller K. Comparison between the C-leg(R) microprocessor-controlled prosthetic knee and non-microprocessor control prosthetic knees: A preliminary study of energy expenditure, obstacle course performance, and quality of life survey. Prosthet Orthot Int 2007;31(1):51 – 61. Download (open access)

Wurdeman SR, Hafner BJ, Sawers A, England DL, Lundstrom R, Kannenberg A. ASsessing Clinical outcomes with microprocEssor kNee uTilization in a K2 population (ASCENT K2): randomized controlled trial results for above-knee prosthesis users over age 65., Disabil Rehabil 2025 Jul1-18

Q&A

Thank you

