C-Leg vs NMPKs

Uneven ground, Obstacle course

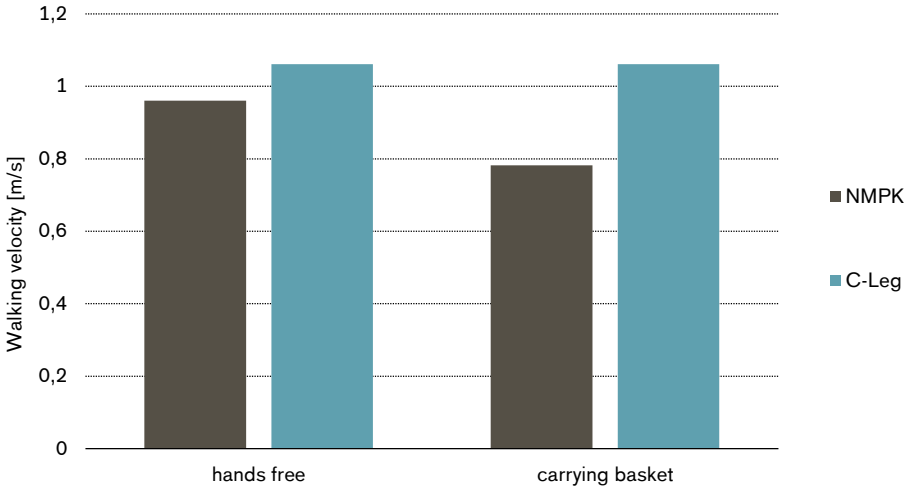
Major Findings

With C-Leg compared to NMPKs:

→ **Improved walking velocity during obstacle course**
in K2 subjects (by 11%) and in K3 subjects (by 6.7%)
with hands free and when carrying a 4.5kg basket

→ **Improved walking velocity on uneven terrain by 21%**

Improved walking velocity during obstacle course with C-Leg compared to NMPK



Seymour et al. (2007)

Clinical Relevance

Walking on uneven ground is needed in daily living when walking over different surface types, such as carpeted, wooden or tiled flooring or different kinds of stairs, ramps or other obstacles and can pose a potential safety risk. It requires different gait biomechanics than walking on level ground. A preferred instrument to investigate the ability to walk on uneven ground is measuring the time needed to navigate through an obstacle course and therefore to determine walking velocity.

Summary

Seymour et al. (2007) conducted a standardized walking obstacle course (SWOC) with two different conditions: In one condition the subjects had their hands free and in the other condition they carried a basket of 4.5 kg weight. The SWOC is a 12.2 meter long walkway starting with a low profile rug and continues with a 30° turn to the right, a 90° turn to the left and then a 70° turn to the right. With the hands free condition, subjects took fewer steps and fewer steps-offs and the walking velocity was increased with C-Leg compared to NMPKs. When carrying the basket, the walking velocity was improved with C-Leg compared to NMPKs. Those findings were confirmed in a later study, reporting that the total time needed to complete the SWOC decreased and therefore walking velocity increased with C-Leg compared to 3R60, a NMPK by Otto Bock. The major improvements with C-Leg were found in the rock and foam section (Meier et al. 2012). Hafner et al. (2009) reported that walking velocity during an obstacle course was increased with C-Leg compared to NMPKs by 11% in K2 subjects and by 6.7% in K3 subjects.

Fastest possible walking speed (FPWS) on uneven terrain consisting of trimmed grass, rocks and uneven sandy terrain was measured over 38 meters. With C-Leg

FPWS on uneven terrain increased by 21% compared to NMPKs (Kahle et al. 2008).

References of summarized studies

Hafner, B. J., & Smith, D. G. (2009). Differences in function and safety between Medicare Functional Classification Level-2 and -3 transfemoral amputees and influence of prosthetic knee joint control. The Journal of Rehabilitation Research and Development, 46(3), 417–433.

Hafner, B. J., Willingham, L. L., Buell, N. C., Allyn, K. J., & Smith, D. G. (2007). Evaluation of function, performance, and preference as transfemoral amputees transition from mechanical to microprocessor control of the prosthetic knee. Archives of physical medicine and rehabilitation, 88(2), 207–217. doi:10.1016/j.apmr.2006.10.030

Kahle, J. T., Highsmith, M. J., & Hubbard, S. L. (2008). Comparison of nonmicroprocessor knee mechanism versus C-Leg on Prosthesis Evaluation Questionnaire, stumbles, falls, walking tests, stair descent, and knee preference. The Journal of Rehabilitation Research and Development, 45(1), 1–14.

Meier, M. R., Hansen, A. H., Gard, S. A., & McFadyen, A. K. (2012). Obstacle course: users' maneuverability and movement efficiency when using Otto Bock C-Leg, Otto Bock 3R60, and CaTech SNS prosthetic knee joints. The Journal of Rehabilitation Research and Development, 49(4), 583–596.

Seymour, R. E. B., Kott, K., Ordway, N., Brooks, G., Crannell, J., Hickernell, E., & Wheeler, K. (2007). Comparison between the C-leg microprocessor-controlled prosthetic knee and non-microprocessor control prosthetic knees: a preliminary study of energy expenditure, obstacle course performance, and quality of life survey. Prosthetics and Orthotics International, 31(1), 51–61. doi:10.1080/03093640600982255