C-Leg vs MPKs

Metabolic energy consumption

Major Findings

With C-Leg **compared to Rheo Knee**:

→ Oxygen costs decreased by 5.1% at self-selected walking velocity
→ Oxygen costs tend to be decreased by 2.7% at fast walking velocity

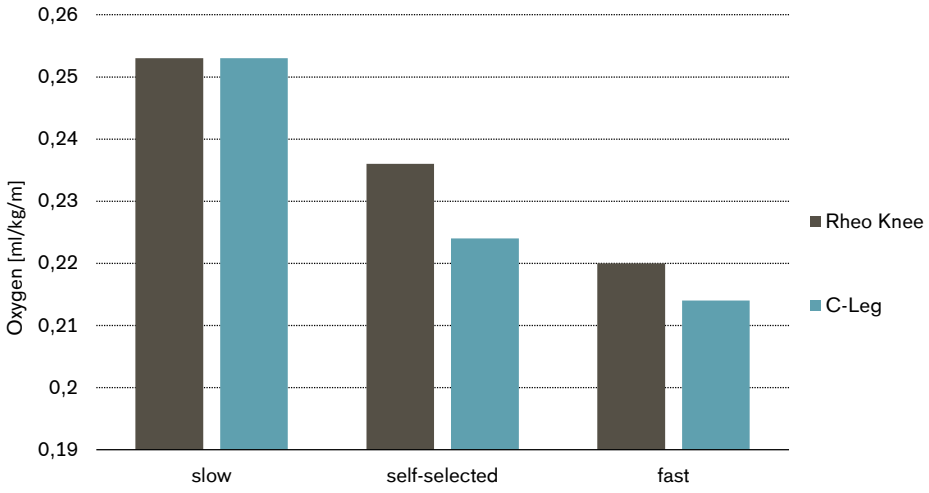
With C-Leg **compared to Intelligent Prosthesis**:

→ Oxygen uptake tends to be reduced by 4.3% up to 6.5% when walking at different velocities

With C-Leg **compared to Hybrid Knee**:

→ Oxygen costs tend to be decreased by 2.7% at fast walking velocity

Decreased oxygen costs with C-Leg



Oxygen costs were measured when subjects walked at different velocities: slow (0.6–0.8 m/s), self-selected (0.8–1.0 m/s) and fast (1.0–1.2 m/s) (Bellmann et al 2010).

Clinical Relevance

Energy expenditure refers to the amount of energy a person uses to perform a certain activity such as walking. The difference between prostheses regarding the energy expenditure is of interest since transfemoral amputees are generally less efficient ambulators. The oxygen consumption of transfemoral amputees is 27% higher compared to able-bodied subjects (Gitter et al. 1995). Energy expenditure is determined based on measurements of oxygen cost, heart rate or carbon dioxide production.

Summary

Oxygen costs decreased at self-selected walking speed by 5.1% with C-Leg compared to Rheo Knee. At fast walking speed, C-Leg showed a trend towards decreased oxygen costs by 2.7% compared to Rheo Knee and Hybrid Knee (Bellmann et al 2010). In contrary, another study showed a trend towards increased oxygen uptake by 3% for C-Leg compared to Rheo Knee (Johansson et al. 2005). Additionally, C-Leg showed a trend towards decreased oxygen uptake by 4.3% – 6.5% compared to Intelligent Prosthesis at different gait speeds (Chin et al. 2006).

References of summarized studies

Bellmann, M., Schmalz, T., & Blumentritt, S. (2010). Comparative biomechanical analysis of current microprocessor-controlled prosthetic knee joints. Archives of physical medicine and rehabilitation, 91(4), 644–652. doi:10.1016/j.apmr.2009.12.014

Chin, T., Machida, K., Sawamura, S., Shiba, R., Oyabu, H., Nagakura, Y., Nakagawa, A. (2006). Comparison of different microprocessor controlled knee joints on the energy consumption during walking in trans-femoral amputees: intelligent knee prosthesis (IP) versus C-leg. Prosthetics and Orthotics International, 30(1), 73–80.

Johansson, J. L., Sherrill, D. M., Riley, P. O., Bonato, P., & Herr, H. (2005). A clinical comparison of variable-damping and mechanically passive prosthetic knee devices. American journal of physical medicine & rehabilitation / Association of Academic Physiatrists, 84(8), 563–575.

Other references

Gitter, A., Czerniecki, J., & Weaver, K. (1995). A reassessment of center-of-mass dynamics as a determinate of the metabolic inefficiency of above-knee amputee ambulation. American journal of physical medicine & rehabilitation / Association of Academic Physiatrists, 74(5), 332–338.