A Comparison of Energy Expenditure in People With Transfemoral Amputation Using Microprocessor and Nonmicroprocessor Knee Prostheses: A Systematic Review


With C-Leg compared to NMPKs:

» **Improved efficiency while walking**

Oxygen consumption may be reduced in particular at slow and fast walking velocities

Energy consumption measured when walking at slow (0.5 – 0.8 m/s) and fast (1.0 – 1.4 m/s) velocity.

**Population**

| Subjects: | 60 subjects |
| Previous prosthesis: | not reported |
| Amputation causes: | 6 articles nonvascular, 1 article mixed |
| Mean age: | 26–75 yrs |
| Mean time since amputation: | not reported |
| MFCL: | 6 articles K3–K4, 1 article K4 |

**Study Design**

- **Included publications:** 7
- **Quality assessment:** average PEDro rating of 3.7 points (range 2 – 5 points)
- **Inclusion criteria:** experimental design, comparative study between NMPK and MPK prosthesis use, an outcome measure of oxygen consumption.
Results

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Category | Results for MPKs vs NMPKs | Reference |
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Metabolic energy consumption | | |
Slow v** | Reduction of mean volume of oxygen consumption per unit of time in 2 out of 3 subjects (n.a.) | Buckley (IP) |
Self-selected v** | No difference (n.a.) | |
Fast v** | Reduction of mean volume of oxygen consumption per unit of time in 2 out of 3 subjects (n.a.) | |
Reduction of net oxygen consumption by 6.2% ** | Reduction of net oxygen consumption by 6.0% ** | Schmalz (C-Leg) |
Reduction of oxygen consumption by 11.1% (n.a.) | Reduction of energy cost by 8.1% (n.a.) | Datta (C-Leg) |
Reduction of net oxygen consumption by 6.2% ++ | Reduction of net oxygen consumption by 6.0% ++ | |
Reduction of oxygen consumption by 11.1% (n.a.) | Reduction of energy cost by 8.1% (n.a.) | |
Increase in energy cost by 7.5% - | Reduction of oxygen costs by 4.5% + | Orendurff (C-Leg) |
Reduction of oxygen consumption by 3.3% ++ | Reduction of oxygen consumption by 8.0% ++ | Seymour (C-Leg) |
Reduction of oxygen consumption by 5.0% + | No difference | Kaufman (C-Leg) |
Reduction of energy consumption during walking with an MPCK was more apparent at speeds other than the self-selected walking speed. |
Energy reduction higher than 5% is assumed as clinically significant. |

no difference (0), positive trend (+), negative trend (−), significant (++/−−), not applicable (n.a.) |
** walking velocity

Author’s Conclusion

“Some evidence suggests that MPK use may reduce energy consumption for high-functioning individuals with nonvascular amputations. However, there is insufficient evidence to suggest that MPK use decreases energy consumption, in general, for adults with unilateral transfemoral amputation compared with non-MPK use.” (Wong et al. 2012)