

C-Leg vs NMPKs

Stairs

Major Findings

With C-Leg compared to NMPKs:

→ **Improved mobility during stair descent**

K2: Stair assessment index score improved from 3.3 to 9 (173% increase)

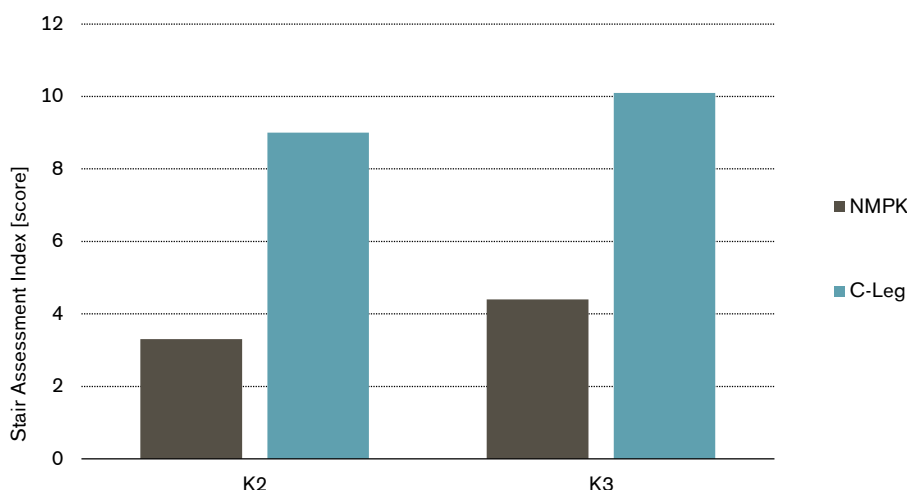
K3: Stair assessment index score improved from 4.4 to 10.1 (130% increase)

→ **Stair descent strategy improved from step-to-step to step-over-step pattern**

→ **Decreased loading of the contralateral side during stair descent**

Ground reaction force decreased by up to 10%

Improved stair descent mobility with C-Leg compared to NMPKs



Hafner et al. (2009)

Clinical Relevance

Stair ambulation is an activity that is important for amputees with an activity level ranging from K2 to K4. Being able to ascend and descend stairs is a requirement to participate in daily life. Evaluation of stair ascent and descent includes stair ascent strategy, use of handrail and/or use of an assistive device.

Summary

Hafner et al. (2007) investigated stair ascent and descent in K2 and K3 subjects using the Stair Assessment Index (SAI). The SAI score for descent improved from 3.7 with NMPKs to 9.6 with C-Leg. A score of 10 points represent a reciprocal stair descent strategy with hand rail and assistive device use on a scale where a score of 13 is the maximum. These results were confirmed by a later study which investigated stair descent. For K2 subjects the SAI score improved from 3.3 with NMPKs to 9.0 (represents skip-step strategy without hand rail or assistive device use) with C-Leg and for K3 subjects the SAI score improved from 4.4 to 10.1 (Hafner et al. 2009). Furthermore, stair descent performance was reported to be improved by 63% with C-Leg compared to NMPKs (Kahle et al. 2008).

Schmalz et al. (2007) analysed stair descent of transfemoral amputees with C-Leg compared to healthy subjects. It was found that the stair descent strategy differs between the two groups: Amputees strike the step with the heel close to the edge and the foot rolls over the edge. In comparison, healthy subjects place strike the step with the ball and the whole foot contacts the step. Toe-off is possible due to a

plantar flexion of the foot. This difference results in decreased ground reaction force and joint moments on the prosthetic side and increased ground reaction force and joint moments on the contralateral side compared to healthy subjects during stance phase (Schmalz et al. 2007). However, in a previous study the same group measured, that with C-Leg ground reaction force on the contralateral side decreased by up to 10% compared to NMPKs and therefore the unphysiological high load is lower with C-Leg (Schmalz et al. 2002). Furthermore, knee flexion moments on the prosthetic side at the end of stance phase are increased by 41% with C-Leg compared to NMPKs resulting from subjects trust to load the prosthesis to a higher extend (Schmalz et al. 2002).

References of summarized studies

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