

Genium vs C-Leg

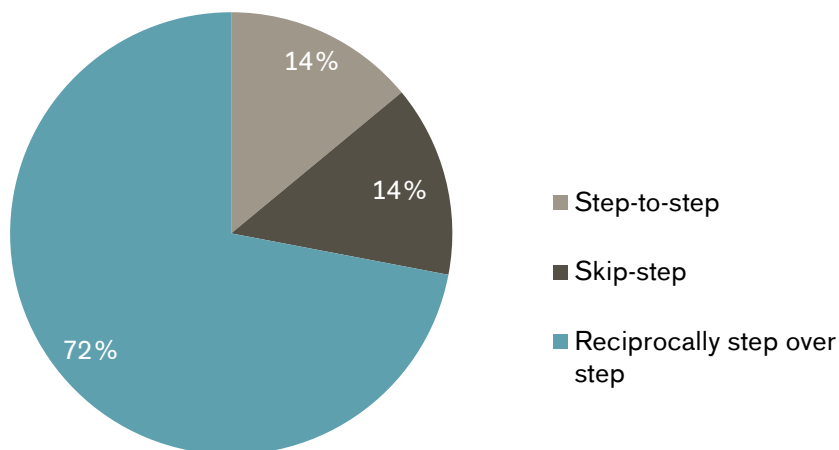
Stairs

Major Findings

With Genium compared to C-Leg:

- **Difficulty of ascending and descending stairs is decreased by 34% and 10%**
- **70 – 80% of subjects are able to ascend stairs with a reciprocal step-over-step strategy**
- **Loading of sound side is reduced by 10% during ascent**
- **Movement of sound side is within range of healthy subjects during ascent**
Movement of hip and knee joints on sound side are reduced by 34% and 33%

Percent of subjects by stair ascent strategy with Genium



Stair ascent strategy was assessed observing 14 subjects (Aldridge Whitehead et al. 2014).

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 includes stair ascent strategy, use of handrail and/or use of an assistive device. Biomechanical assessment is conducted to determine load on the joints and joint angles and to compare them to values measured in healthy subjects.

Summary

The assessment of stair ascent strategy was conducted by multiple groups. Bellmann et al. (2012a) reported that 80% of subjects were able to ascend stairs reciprocally after only one day of using Genium. These findings were confirmed by Highsmith et al. (2014), reporting 70% of subjects, and by Aldridge Whitehead et al. (2014), reporting 72%. Lura et al. (2017) found that from the subjects who were able to use a reciprocally step-over-step strategy to ascend stairs, 41% preferred it over step-to-step strategies, compared to C-Leg users in which preference was only 5%. Furthermore, an improvement of the Stair Assessment Index (SAI) from 5 to 11 points (Aldridge Whitehead et al. 2014) respectively from 6 to 11 points (Highsmith et al. 2016) was achieved by switching from C-Leg or an NMPK to Genium. A score of 11 points represent a reciprocal stair ascent strategy with hand rail or assistive device use on a scale where a score of 13 points is the maximum.

The reciprocal stair ascent strategy is accomplished with Genium by means of an additional function, activated by a backward movement of the prosthesis after lifting the foot (Kampas et al. 2011).

Although the duration of a stride during stair ascent is longer with Genium than with C-Leg, a clear approximation to the movement pattern of healthy subjects was observed when using Genium. The movements of the knee and hip joints on the contralateral side were decreased and the loading of the contralateral knee joint was reduced with Genium compared to C-Leg (Bellmann et al. 2012b & Blumentritt et al. 2012). Moreover, hip and knee flexion during swing phase were increased and therefore toe clearance during stair ascent increased (Aldridge Whitehead et al. 2014). The peak flexion angle and swing period increased significantly with Genium (Lura et al. 2017). All these changes led overall to a decreased between-limb difference with Genium and contribute to a more symmetric gait, compared to C-Leg.

Besides improvement in stair ascent strategy and gait characteristics, subjects reported that ascending and descending stairs was perceived as less difficult with Genium than with C-Leg (Kannenbergh et al. 2013).

In a retrospective, cross-sectional cohort analysis from Hahn et al. 2016, clinically important factors on performance using Genium were analysed based on 899 trial fittings. Descent and ascent from stairs presented a very clear responsiveness in 38.3% and 63.10% of subject's perception category, respectively. Reciprocal stair ascent exhibit the highest number of sensitive confounders (25) for the advanced manoeuvres category. However, none of the factors qualified as predictor for performance.

References of summarized studies

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