

**Author**

Lathouwers, Elke (Brussels BE)

Vrije Universiteit Brussel - Human Physiology and Sports Physiotherapy

**Title**

Physiological evaluation of the Talaris Demonstrator: a state-of-the art passive ankle-foot prosthesis.

**Coauthors**

Ampe T, De Pauw K, Meeusen R

**Summary**

The TD is a newly developed passive ankle-foot prosthesis. Preliminary results are encouraging and indicate increased comfort with the TD during different walking tasks compared to the participant's current prosthesis. Further investigations will continue to probe potential benefits of the TD.

**Introduction/ basics**

Current ankle prosthesis for people with a unilateral transtibial amputation (TTA) or transfemoral amputation (TFA) are unable to mimic able-bodied performance during daily activities. Despite the transition from passive to micro-processed and more recently to active prosthetic devices, this gap remains. A possible explanation for not alleviating the gap could be the limited range of motion of the prosthetic ankle joint. To further optimize the gait pattern of people with a lower limb amputation, a new mechanical ankle-foot prosthesis was developed. This device contains an articulated ankle joint allowing plantar and dorsal flexion. The purpose of this preliminary study was to evaluate the "passive Talaris demonstrator" (TD) during daily activities by means of performance-related, physiological and subjective outcome measures.

**Material method; implementation/ process**

Participants with a TTA and TFA completed a protocol assessing performance and functional mobility with both their current prosthesis and the TD. It comprised the L-test, 2 minutes of stair climbing, 2 minutes of inclined treadmill walking, 6 minutes of treadmill walking at 3 different speeds in consecutive blocks of 2 minutes and a 3-meter Backward Walk test (3mBWT). Heart rate was gathered during each task and oxygen uptake was collected during all tasks except for the L-test and 3mBWT. Time was recorded on the L-test and 3mBWT, and the rate of perceived

exertion (score= 6-20), fatigue and comfort (score= 0-100) were questioned after each task. Statistical analysis was performed to compare results between prosthetic devices. If normality was assumed, a paired sample t-test was applied. If not assumed, the non-parametric Wilcoxon Signed-rank test was conducted. Benjamini-Hochberg corrections were applied to control for multiple comparisons with a level of significance set at  $\alpha = 0.05$ .

## Results

Preliminary results indicated no differences regarding heart rate, oxygen consumption, comfort and fatigue in people with a TTA (N=23). The only significant parameters indicated that participants with a TTA were faster with their current prosthesis compared to the TD on the L-test and 3mBWT ( $p = 0.040$ ). The mean difference equalled 1.34s on the L-test and 0.52s on the 3mBWT. In participants with a TFA (N=14), we found an increased oxygen consumption during 6 minutes of treadmill walking (mean difference =  $1.1 \text{ ml} \cdot (\text{kg} \cdot \text{min})^{-1}$ ;  $p = 0.034$ ) with the TD compared to the participants' current prosthesis. Additionally, we observed a tendency towards a higher heart rate during the L-test (mean difference = 3 bpm) and towards increased comfort during inclined walking and 6 minutes of treadmill walking (mean differences = 14 and 10, respectively), with the TD compared to the participants' current prosthetic device ( $0.05 < p < 0.10$ ).

## Discussion/ conclusion; conclusion for the practice

In people with a TTA, the observed differences are not deemed clinically significant. For participants with a TFA, the observed differences in heart rate and oxygen consumption indicate that walking with the TD is more energy demanding. This may be attributed to the fact that participants were not provided with a one-month familiarization period to get acquainted with the TD. Nevertheless, we observed a tendency towards an instantaneous increment in comfort while walking with the TD compared to the current prosthetic device. This implies that participants prefer the TD due to its articulated ankle joint providing flexibility. These preliminary results are promising and further investigations unravelling both acute and more prolonged adaptations will be conducted to evaluate the TD more thoroughly.

## References

-

