**Day 1 – 17 September 2009**,
Session 2: Intervention Studies (cont.), 14:40–15:40,
Lecture Theatre

**O9**

## First clinical results with the new innovative robotic gait trainer LOPES

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**Summary**

The results of five chronic stroke patients in a first explorative training study using the new robotic device LOPES are presented.

**Conclusions**

Positive effects of gait training in LOPES were found in four out of five subjects. Future study will focus on including larger sample sizes and introducing LOPES in rehabilitation care of acute stroke patients.

**Introduction**

Robotic devices for gait rehabilitation enable task specific and intensive training, without placing high physical demands on physiotherapists. Previous devices like Lokomat [1] and Gait Trainer [2] are generally characterised as position controlled: enforcing gait by moving the legs through prescribed patterns. An active contribution of the patient is not necessary, and movement errors are not experienced. Both are crucial in motor learning. Recently, a new gait trainer (LOPES) was developed, which can selectively and partially support different aspects of gait at specified gait cycle phases. In a first study LOPES was used in chronic stroke patients with stiff knee gait.

**Patients/materials and methods**

The prototype of LOPES was used (Fig. 1). The exoskeleton has eight actuated degrees of freedom [3]. The robot is impedance controlled, i.e. it applies assistive forces proportional to the deviation of the actual movement to a reference movement. This study focussed on supporting step height (foot clearance) using virtual model control [4]. An adaptive impedance controller was used that adapted the amount of support based on the experienced "movement error" in the previous step, increasing it when errors were large, decreasing it when errors were small. Five chronic stroke patients (age 50–61 y, time since stroke 6–72 m) received the support during a 6-week training program (3 times per week, max 45 min per session) as part of a larger study. Besides improving foot clearance, the training aimed at increasing walking speed and endurance. Gait analysis and clinical tests (3 min and 10 m walking test) were performed pre and post training. Patient satisfaction was assessed using a custom-made questionnaire.

**Results**

Four subjects improved after the training program: mean paretic knee flex/ext range improved with 4.3° (range 0.2–9.6°) and mean paretic knee angular velocity increased with 36.3°/s (range 24.1–58.4°/s). Mean walking distance improved with 19 m (range 14.0–21.8 m), walking speed increased with 0.04 m/s (range 0.03–0.05 m/s). One subject showed a different pattern: mean paretic knee flex/ext range and angular velocity decreased (5.9° and 48.2°/s, respectively). Walking distance and walking speed decreased with 6 m and 0.02 m/s, respectively. All subjects enjoyed the LOPES training and reported positive effects on gait pattern and endurance.


**Fig. 1.** Subject walking in LOPES.

**Discussion**

A small sample size was included as this is a first explorative study using LOPES in stroke patients. Results of gait analysis and clinical tests show positive effects of training in four out of five subjects. The subject showing negative effects experienced a fall in the home situation, thereby interrupting the training program with 1 week. All subjects reported positive on using LOPES as a gait training device.

**References**

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doi:10.1016/j.gaitpost.2009.08.013

**O10**

## Tibialis anterior tendon shortening in combination with Achilles tendon lengthening in spastic equinus in cerebral palsy

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**Summary**

Tibialis anterior tendon shortening (TATS) in combination with tendon Achilles lengthening (TAL) in spastic equinus in cerebral palsy (CP) is a safe procedure and provides an excellent correction of the gait pattern including dorsiflexion in swing. In all operated