**Experimental data measurement to validate the biomechanical simulations of a decrease knee flexion and a decrease hip extension**

**Material**

* 26 reflective markers

**Preparation Before the Participant Arrives**

* Administrative
* Print documents
* CAREN system
* Start Vicon Nexus (to record), camera, and D-FLOW
* Calibrate Vicon (light condition to 1).
* Prepare: 26 markers, tape, IMUs.
* Calibrate D-flow

**Study Introduction**

* Welcome the participant
* Explain task:

“Today, we want to record your gait data. The study aims at understanding the relationship between gait metrics in a stroke-like gait on healthy subjects. The session will be divided into 3 parts: (1) First, we will ask you to walk normally on the treadmill at your preferred speed, (2) Secondly, we will ask you to adopt a right stiff knee gait i.e. to restrict your knee range of motion (ROM) in a desired range while being guided by a visual feedback. (3) Finally, we will ask you to walk with the requirement of constraining the ROM of your right hip within a specified range while guided by the visual feedback.”

**Participant Preparation**

* Participant changes clothes and takes off shoes while leaving his/her socks. If the patient wears jewelry, he/she’ll be asked to take them off.

**Calibration and Data Collection**

* Participant Calibration in Vicon Nexus and D-Flow:
* T-pose on treadmill (6s) + take two steps forward
* Check that all markers are visible (take a picture of the right markers so that you try to place them at the same position once the subject wears the knee brace)
* Find preferred gait velocity (PGV):
* **FGV**: Ask the subject to walk on the treadmill at a neutral 1 [m/s] and slowly increase the speed until the subject tells you it is too fast compared to his/her normal speed.
* --- STOP and go back to 1 [m/s]
* **SGV**: Ask the subject to walk on the treadmill at a neutral 1 [m/s] and slowly decrease the speed until the subject tells you it is too slow compared to his/her normal speed.
* ---STOP : PGV = (FGV + SGV)/2
* **PGV**: Train the subject to walk on the treadmill at his/her PGV:

“You will walk on the treadmill at your PGV for 6 minutes to get used to the treadmill and then we can start with the study.”

Normal walking:

* After the subject walked for 6 minutes at his/her PGV, we record 50 gait cycles

“Now, you’re going to walk for about 3 minutes at your PGV while we record your gait cycle data”

Feedback:

* **Decrease knee flexion**: Set the treadmill speed at the PGV and turn on the visual feedback:

“Now, we move on to the feedback phase. We will ask you to adopt a right stiff knee gait i.e. to restrict your knee ROM in a desired range [0,55] degrees [1] while being guided by the visual feedback. The feedback will indicate you in green the range of motion of the knee that we want you to adopt. The moving bar will indicate you the angle of your knee. Your aim is to adapt your gait such that the moving bar lies within the green region. The feedback is always calculated on your right leg so that’s the side you should try to modify to reach the green region. We’ll start with a training session of 3 minutes during which you’ll try to modify your gait to reach the green region. After the training session, we’ll record about 50 gait cycles.”

* **Decrease hip extension**: Set the treadmill speed at the PGV and turn on the visual feedback:

“Now, we move on to the feedback phase. We will ask you to walk with the requirement of constraining the ROM of your right hip within a specified range [0,40] degrees [2] while guided by the visual feedback. The feedback will indicate you in green the range of motion of the knee that we want you to adopt. The moving bar will indicate you the angle of your hip. Your aim is to adapt your gait such that the moving bar lies within the green region. The feedback is always calculated on your right leg so that’s the side you should try to modify to reach the green region. We’ll start with a training session of 3 minutes during which you’ll try to modify your gait to reach the green region. After the training session, we’ll record about 50 gait cycles.”

**References**:

[1] Boudarham et al., Effects of Quadriceps fatigue on stiff-knee gait in patients with hemiparesis, Plos One, 2014

[2] J. Boudarham et al., Variations in kinematics during clinical gait analysis in stroke patients, PLOS One 8(6): e66421.doi:10.1371/journal.pone.0066421