INTRODUCTION

Gait is a complex motor task that requires both low level rhythmic pattern generation as well as higher order cerebral control. With aging neurophysiological changes occur that may affect the ability to maintain stable gait. The purpose of this study was to examine the interrelationships between striatal dopaminergic denervation, oscillatory rhythmic foot movements, and gait in healthy older adults.

METHODS AND PROCEDURES

Presented here is preliminary data of a larger research effort into underlying mechanisms of falling. The data of 17 normal healthy older adults (5/12 f/m, age = 66.7 ± 11.7 yrs., range 50-84 yrs.) has been analyzed thus far. Subjects were normal upon neurological and physical examination. Mobility and motor functioning were assessed, of which the gait and foot-tapping data are presented here. All subjects provided IRB-approved written informed consent prior to testing.

Dopamine Imaging: Standard $[^{11}C]-$DTBZ Positron Emission Tomography (PET) imaging of the vesicular monoamine transporter type 2 (VMAT2) ligand was performed. Standard VMAT2 PET analyses methods were used to determine the striatal (i.e. bilateral caudate nucleus and putamen) binding potential (BP) for dopamine. This is a unitless estimate of the amount of dopamine in the striatum (Figure 1).

Gait Testing: A telemetry system (BIOPAC Systems, Inc) was used to record heel and toe strike through pressure-sensitive transducers (Figure 2). Subjects were asked to walk in their own shoes at a self-selected normal pace for 8 meters. This was repeated four times. All subjects wore a safety harness and were trailed closely to prevent from falling. Standard temporal gait parameters were calculated.

Rhythmic Pattern Generation Assessment: Foot tapping was taken as a measure for the ability to generate rhythmic oscillatory movements. A new device was designed and built in our lab that was able to measure...
Oscillatory rotations of the foot, the so-called foot-tapper (Figure 3).

**Figure 2.** Typical gait data from the heel (row 1) and toe (row 2) transducers of the left foot (top 2 rows) and the right foot (bottom 2 rows).

**Figure 3.** Typical oscillations recorded electronically with ADAMView (Advantech) from the foot-tapper device.

The foot-tapper consists of a rotary encoder (Encoder Products Co.) attached to a foam-covered wooden pedal that could rotate freely. Testing was done with shoes off, and the subject was asked to generate as many foot taps as possible in ten seconds with one foot. This was repeated five times and the task was repeated with the other foot. Total number of taps, frequency and amplitude were calculated.

**RESULTS**

Corrected for age and walking speed, there were significant negative correlations between striatal VMAT2 BP and measures of temporal gait variability, i.e. with Stride Time variability (r=-0.730, p=0.011), Stance Time variability (r=-0.735, p=0.010), and Step Time variability (r=-0.769, p=0.006). Corrected for age, none of the foot-tapper measures correlated with striatal VMAT2 BP, nor did any of the foot-tapper measures correlate with any of the gait measures.

**DISCUSSION**

These preliminary results showed negative correlations between striatal dopaminergic BP and temporal measures of gait variability, independent of age and walking speed. With a decrease in striatal dopamine, temporal aspects of gait became more unstable. There were no robust associations between dopaminergic BP and foot-tapper measures.

Also, foot-tapper data did not correlate with gait data. This finding is in line with findings by Hausdorff et al. (2005), who showed that a complex catching task was associated with gait control, whereas rhythmic finger tapping showed no relationship.

**SUMMARY**

Striatal dopaminergic control plays an important role in the regulation of gait, but not in the regulation of oscillatory foot movements. Oscillatory foot movements are not robustly correlated with gait parameters. More data is needed to strengthen or disprove these statements.

**REFERENCES**


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