

# EFFECTS OF AGING ON GAIT INITIATION WHEN COMBINED WITH A CHANGE OF DIRECTION

Evelyn Anaka<sup>1-2</sup> and Philippe Corbeil<sup>1-3</sup>

<sup>1</sup> Division de kinésiologie, Université Laval, Québec, Canada; <sup>2</sup> Unité de recherche en gériatrie de l'Université Laval (URGUL); <sup>3</sup> Centre d'excellence sur le vieillissement de Québec; Email : [Philippe.Corbeil@kin.msp.ulaval.ca](mailto:Philippe.Corbeil@kin.msp.ulaval.ca)

## INTRODUCTION

Gait initiation (GI) is the transition between quiet stance and steady state gait. Typically, when gait is initiated straight ahead, the body's net center of foot pressure (COP), which starts centered between the feet just anterior to the malleolus, first moves posteriorly towards the limb which will take the first step (swing limb), then shifts laterally towards the stance limb and finally anteriorly as the first step is taken (Mann et al. 1979). With this pattern, two main objectives of GI are fulfilled; the swing limb is unloaded to take the first step and the body's center of mass (COM) is accelerated anteriorly (Breniere et al. 1987).

It has been proposed that, for young adults (YA), the postural adjustments prior to the start of GI are modulated to generate the propulsive forces required to orient the COM displacement towards the desired direction of gait progression (Anaka and Corbeil 2007) as well as to reach the intended gait speed by the end of the first step (Breniere et al. 1987).

It has been shown that in older adults (OA), the COP's posterior shift at the start of GI generates less COM forward momentum than in YA (Polcyn et al. 1998). In addition, compared to YA, healthy OA take a shorter first step during GI (Mbourou et al. 2003).

The aim of this current study is to identify whether OA use the same strategies as YA to initiate gait towards different directions.

## METHODS AND PROCEDURES

Healthy adults, aged 20 to 30 and 65 to 75 years old, initiated gait with their right (swing) limb towards five directions (-40°, -20°, 0°, 20° and 40°) at a normal and fast self-selected walking speed. When gait is initiated towards the positive directions, the swing limb is on the desired side of gait. When gait is initiated towards the negative directions, the swing limb is on the opposite side of the desired gait and the swing and stance limbs cross during the first step.

Participants initiated gait from an AMTI force platform embedded into a 5m walkway at an auditory start signal. At the start of each trial, participants were told which angle to position themselves in and looked straight ahead at the corresponding sign indicating the angle. Ground reaction forces as well as full body kinematics were recorded.

Speed conditions were blocked, the order alternated between participants, and starting angles were presented randomly. Each participant completed eight trials per condition for a total of 80 trials.

The medio-lateral (ML) and antero-posterior (AP) COP coordinates, relative to the participant at the start of each trial were analysed at three events; A) the furthest lateral displacement towards the swing limb; B) the change from predominant lateral shift to predominant anterior shift of the COP; C) the position of the COP just prior to swing heel strike. The speed and direction of COM velocity, relative to the desired direction of gait, will be analysed at the same three events. The position and orientation of the first step will also be analysed.

Results were analysed using a mixed-design ANOVA, with Angle and Speed as within factors and Age as between factor. A post-hoc analysis (Tukey) was performed for all significant effects ( $\alpha=0.05$ ).

## RESULTS

Preliminary results show that both YA (n=7) and OA (n=5) modify their COP trajectory with regards to the desired direction of gait.

The ML position of the COP at event A is further towards the swing limb when gait is initiated towards a negative direction and more medial when gait is initiated towards a positive direction for both YA and OA ( $P_s < 0.001$ ).

The AP position of the COP at event A has a significant Angle/Speed interaction ( $P < 0.001$ ). For both YA and OA, the COP at event A is more posterior at the fast speed ( $P_s < 0.001$ ) except at the  $-40^\circ$  condition. In addition, the COP at event A at the positive starting angles is less posterior than the  $0^\circ$  condition for both

YA and OA at both speed conditions ( $P < 0.05$ ).

## DISCUSSION

Preliminary results show that GI combined with a change in direction is associated with a modulation of the postural adjustments prior to the start of movement. Further analysis of COM velocity as well as the position and orientation of the foot at the first step, will provide insight on the organisation of GI. This data will indicate whether OA use the same GI strategies as YA when GI is combined to a change in direction.

## SUMMARY

In both young and older adults postural adjustments are modulated in order to initiate gait towards the desired direction of progression.

## REFERENCES

- Anaka and Corbeil. ISPGR, Burlington (VT), 2007.
- Breniere et al. (1987). J Mot Behav **19**(1): 62-76.
- Mann et al. (1979). J Bone Joint Surg Am **61**(2): 232-9.
- Mbourou et al. (2003). Gerontology **49**(1): 21-6.
- Polcyn et al. (1998). Arch Phys Med Rehabil **79**(12): 1582-9.

## ACKNOWLEDGEMENTS

This study was supported by a grant from NSERC. EA was supported by a scholarship from URGUL.