Physical and Cognitive Exercises (Dual-Task Training) to Prevent Falls in Dementia: a pilot study

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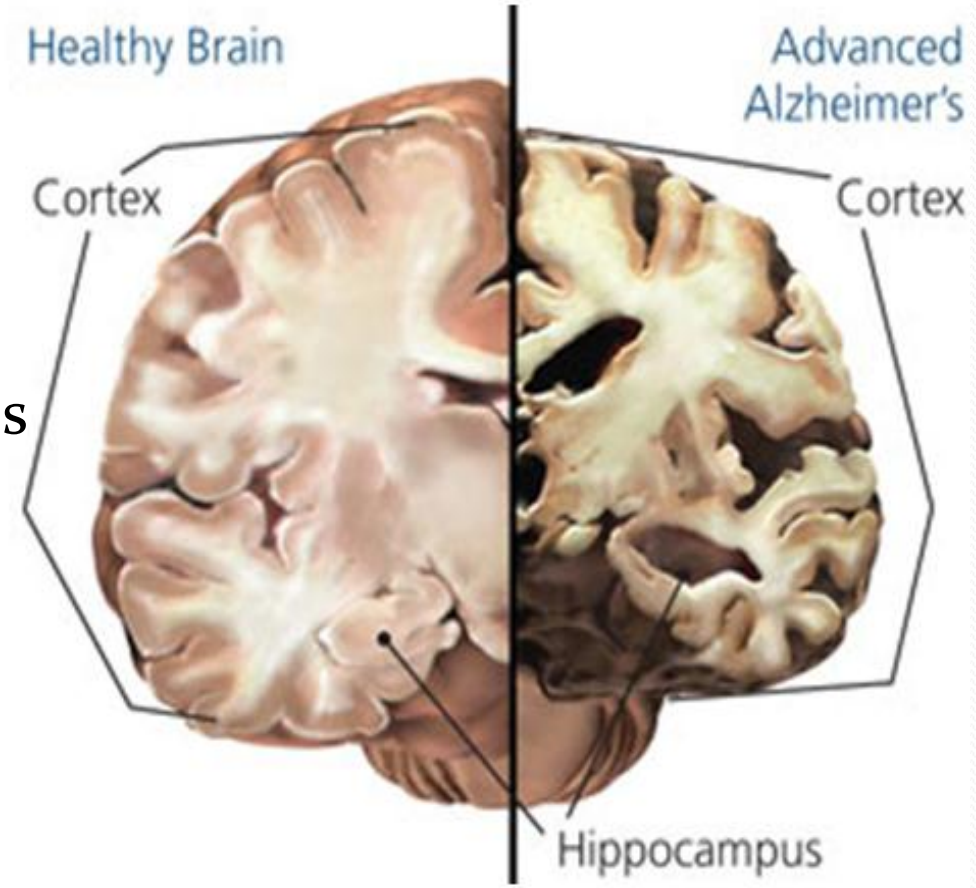
Introduction

- Emerging area of falls research is the role of cognition on the control of postural stability
- Postural stability is a complex process
  - coordination of motor and sensory systems through higher order neurological processes (Horak 2006)
    - in particular executive function (Shumway-Cook & Woollacott 2000)
- Executive function impairment consistently associated with increased fall risk (Muir et al. 2012)

Neuroanatomy of Postural Stability

- Anatomy:
  - Prefrontal cortex
  - Hippocampus
- Pathology:
  - Alzheimer Disease
    - Impaired brain structures



Falls in the Cognitively Impaired

- Currently 480,600 people with dementia in Canada
  - 103,700 new cases per year
  - By 2038: 1,125,200 people with dementia
    (Rising Tide: the impact of dementia on Canadian society, Alzheimer Society of Canada 2010)
- Annual fall risk 60-80% (Shaw 2007)
- ↑ risk for fall related injuries
  - hip fractures (Kallin 2005; Tinetti 1988)
  - ↓ functional outcomes
  - ↑ institutionalization (Morris 1987)
  - ↑ mortality
  - ↓access to rehabilitation (Beaupre 2008)

Fall Prevention among the Cognitively Impaired

- Older adults with cognitive impairment can comply with:
  - Multifactorial interventions (Shaw 2003)
  - Programs to improve physical function (Brill 1995; Jensen 2003)
  - Complex exercise programs (Schwenk 2010)
- Exercise training increases fitness, physical function, cognitive function, and positive behavior (Heyn 2004)
- Exercise programs to prevent falls in the cognitively normal do not work in the cognitively impaired
  - Requires novel interventions and accommodation for disease related deficits

Evaluation of Cognition in Postural Stability

- Dual-task paradigm
  - Observing people during a gait or balance task while they perform a secondary task
  - "Stops walking while talking" (Lundin Olsson 1997)
- Relevant
  - Most activities of daily living involve the simultaneous performance of two or more cognitive and motor tasks
  - Representative of real life situations where falls are likely to occur

Study Rationale

- Postural instability increases during the performance of multiple tasks simultaneously
  - Need for training balance in both single and dual-task conditions
- Novel fall risk reduction rehabilitation intervention needed in community-dwelling older adults with dementia
- Specific objectives:
  - Determine the effect of dual-task training
  - Identify barriers to rehabilitation

Study Objectives

- To determine the effect of physical and cognitive (dual-task) training on gait, balance, strength, and cognitive function in community-dwelling older adults with dementia.
- To determine barriers to rehabilitation for people with dementia through semi-structured interviews with participants and caregivers, and evaluate caregiver burden during and after the intervention.

Methods

- 12 week exercise intervention:
  - Mild to moderate Alzheimer disease
  - 3 times a week
  - Home based exercise program
  - Care-giver as coach
  - Home visit by physical therapist every 2 weeks
- Based on the Otago Exercise Program
  - Lower extremity strengthening exercises
  - Balance exercises
    - Paired with cognitive exercise
  - Walking program

Methods

- Clinical assessment pre and post-intervention
  - Cognitive testing
    - MMSE
    - MoCA
    - ADAS-cog
    - Trail Making Test A & B
    - Digit Span Test
  - Physical function
    - Gait - electronic mat
    - Balance - 4 clinical tests and posturography (force platform)
    - Lower extremity strength
- Falls – one year follow-up after completing exercise program

Results

- Recruitment:
  - Difficulty recruiting
  - Barriers reported for not participating in study:
    - Not interested in participating in research
    - Care giver burden
    - Not interested in exercise
- Presentation of results from n=6 completed exercise program
  - Sample:
    - 78.0±4.9 yrs, 83% male
    - MMSE = 22.3±5.3 MoCA=20.5±5.3
    - 50% moderate activity level
    - 83% no history of falls, not afraid of falling

Results

- All participants:
  - Able to perform the exercises
  - Able to do the exercises 3 times a week
  - Able to be progressed in the exercises over the 12 weeks
- Improvement in cognition:
  - Executive function (Trail Making Test B) $p<0.016$
- Gait, strength and balance remained unchanged
- Caregivers reported:
  - Improved mobility
  - Attention in the participants
  - No added burden to be coach

Conclusions

- In light of the recruitment barriers:
  - Caregiver burden
    - Offering the exercise program through regional day program for community-dwelling older adults with Alzheimer disease
  - Exercise
    - Need to find methods to motivate the sedentary to commence an exercise program
- Older adults with mild to moderate Alzheimer disease able to participate in dual-task training program
  - Gains seen in cognitive function
  - Need to establish the best methods to evaluate physical function to find changes
- Awaiting one year follow-up information on functional trajectories and falls

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