CHAPTER 3

METHODS

3.1 Participants

Thirty participants (15 individuals with aMCI and 15 healthy controls) aged 50 years or older were recruited. This sample size was calculated using G*Power 3.0.10. The estimated sample at the power of 0.8, medium effect size and a 0.05 alpha level requires recruitment of 15 individuals with aMCI and 15 healthy controls of a similar age range and gender.

The diagnosis of aMCI was performed by a neurologist using Petersen's criteria as follows (7, 15):

1) Presence of memory complaint (self-report or/and informant information)
2) Normal global cognitive function, as determined by a clinician's judgment based on a structured interview with the patient and an informant. A score on a standardized memory test rated as 0.5 (memory domain) on Clinical Dementia Rating (CDR) or/and greater 23 scores on Mini-Mental State Examination-Thai 2002 (MMSE-Thai 2002) (Appendix B)
3) No or minimal impairment in activities of daily living (ADLs), as determined by clinical review with the patients and informant
4) Stable general health with no significant cerebral vascular disease
5) Results from a computed tomography (CT) or magnetic resonance imaging (MRI) (15) within 12 months before screening show no indication of brain infection, infarction or focal lesions

3.1.1 Inclusion criteria

The participant was included in this study if he/she:

1) Able to comprehend instructions and to participate
2) Can walk independently for at least 10 meters without rest
3) For participants with aMCI, have been diagnosed with aMCI by neurologist based on Petersen's criteria (7,15)
4) Healthy control group: no cognitive impairment using MMSE-Thai 2002 (score > 23) (Appendix B) screened by Neurologist, age and gender matched with aMCI group.

3.1.2 Exclusion criteria

1) Presence of neurological disorders that affect cognitive impairment (e.g. Parkinson's disease, Stroke)
2) Presence of depressive symptoms defined as a score more than 13 on Thai Geriatric Depression Scale (TGDS) (Appendix C) (46)
3) Severe cardiopulmonary conditions (e.g. Asthma, Chronic Obstructive Pulmonary Disease)
4) Uncorrected visual and hearing impairment
5) Taking alcohol 6 hours before testing or using drug regimens that affect gait performance such as sedative and antidepressant

3.2 Equipment

3.2.1 Personal data collection form (Appendix A)

3.2.2 Cognitive test record form (Appendix D)

3.2.3 GAITRite® system, (CIR system, USA) is a carpet 460 cm long with an

active sensor area of 366 cm long and 61 cm wide with sensor pads (12.7 mm apart from each other) and a sampling frequency of 80Hz. Previous work demonstrated that the GAITRite® system has good concurrent validity and high test– retest reliability when examined under both single- and dual-task conditions in MCI persons (9).

3.2.4 Masking tape

3.2.5 Cones

3.2.6 Video camera

3.3 Independent and dependent variables

Independent variables were

3.3.1 Group

1) Healthy control group

2) amnestic MCI group

3.3.2 Testing Condition: Single tasking (i.e. walking) and dual-tasking (walking in concurrent with performing a cognitive task). The testing were consisted of 4 conditions:

1) walking (W)

2) walking while performing Digit Span task (W+SA)

3) walking while performing serial 3 subtractions task (W+EF)

4) walking while performing verbal fluency task (W+VF)

Dependent variables were

Spatio-temporal gait parameters focused specially on average stride-length and gait speed and variability of stride length and swing time

3.4 Procedures

The study protocol was submitted for approval by the Human Ethical Review Board of the Faculty of Associated Medical Sciences, Chiang Mai University and Saunprung Hospital. Participants who were eligible to participate in the study based on the inclusion and exclusion criteria were informed about the purposes and procedure of the study before signing an informed consent. Demographic data of the participants which consisted of height, weight, medical conditions, and history of falls in the past year were recorded. The Digit Span (Appendix D), serial 3 subtraction and verbal fluency tests were administered prior to gait testing as baseline values. Temporal and spatial parameters of gait were assessed using GAITRite® system.

3.4.1 Setting and Participant Preparation

The starting and stopping line were marked on the floor at 2 meters from each end of the gait mat to reduce potential effect of gait initiation (acceleration) and termination (deceleration). The task was to walk barefoot, with each participant's usual comfortable speed from the starting line to the stopping line 6 trials for each condition. Enough rest was provided between each trial. Standardized verbal instructions on the test procedure were given followed by a demonstration of a walking test. A practice trial was performed to allow participants to become familiar with the procedure.

3.4.2 Testing

The order of the 4 testing conditions was randomized, counter balance across participants.

1) Walking (W): Participants were instructed to walk with their usual comfortable speed.
2) Walking while performing Digit Span task (W+SA): Participants were asked to walk with their usual comfortable speed while performing digit span test. A series of digits strings were read to the participants and they were required to repeat verbally in the correct sequence (34).
3) Walking while performing serial 3 subtractions task (W+EF): Participants were asked to walk with their usual comfortable speed while subtracting three from the random two digits numbers and then continue subtracting three from prior answer until completing gait task (29).
4) Walking while performing verbal fluency task (W+VF): Participants were asked to walk with their usual comfortable speed while naming words under specific constraints categories as many words as possible (35).

3.5 Gait parameters

3.5.1 Mean Gait parameters (36)

1) Stride length (m) was determined by the distance from the point heel contact of one extremity to the point of heel contact of the same extremity
2) Gait speed (m/s) was determined by the distance covered in a given amount of time
3) Swing time (s) was determined by the time elapsed between the last contact of the current footfall to the first contact of the next footfall

3.5.2 Gait variability

The coefficient of variation was used to quantify the variability of stride length, and swing time. The CV for each gait variability parameter was determined by the following equation: CV = (SD/mean) x 100%.

3.6 Statistical analysis

2 Groups (aMCI, Con) X 4 walking conditions (W, W+SA, W+ EF, W+VF) mixed model repeated measures analysis of variance (ANOVA) was conducted to address the research question. Post hoc analyses of any significant interactions were conducted using pairwise comparisons with a Bonferroni correction. For all statistical tests, a level of significance was set at $p < .05$. Partial Eta squared values were reported as measures of effect size.

3.7 Data collection location

The study was conducted at the Department of Physical Therapy, Faculty of Associated Medical Sciences, Chiang Mai University.