Chapter 11
Tactile Pattern Delivery Device to Investigate Cognitive Mechanisms for Early Detection of Alzheimer’s Disease

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ABSTRACT
The cognitive symptoms in early Alzheimer’s disease (AD) involve problems with learning, memory or planning. Currently, no medical tests are available to conclusively diagnose dementia pre-mortem. Previous studies have demonstrated that the cognitive deficits of AD can be detected during a preclinical period with neuropsychological tests. This chapter’s hypothesis is that cognitive deficit symptoms of AD are detectable using a combination of tactile, kinetic, cognitive, and functional MRI tasks in the earliest stages of the disease. The authors of this chapter offer a novel approach to investigate the early detection of AD with tactile procedures. This chapter introduces the development of two tactile pattern delivery
INTRODUCTION

Alzheimer’s disease (AD) is one of the most devastating brain diseases in middle-aged and elderly humans in modern society. AD is an irreversible, progressive brain disease that slowly destroys memory, thinking skills and, eventually, the ability to carry out the simplest tasks of daily living. Worldwide, the number of AD patients was reported to be 24.3 million people in 2005, and it is estimated that the number of patients will increase to 42.3 million people in 2020. Currently, no medical tests are available to diagnose dementia conclusively pre-mortem.

The causes and progression of AD are not well understood. However, there are some hypotheses that exist about the cause of the disease. The oldest is the cholinergic hypothesis, which proposes that AD is caused by reduced synthesis of the neurotransmitter acetylcholine. This hypothesis has not maintained widespread support. Currently, the amyloid hypothesis postulates that amyloid β-peptide (Aβ) deposits are the fundamental cause of the disease, and this view is widely supported.

The most commonly recognized symptom of AD patients is memory loss or cognitive deficits, such as difficulty in remembering recently learned facts. People with AD die an average of 4 to 6 years after diagnosis, but the duration of the disease can vary from 3 to 20 years. At a certain point, patients with AD display more rapid deterioration of cognitive function than healthy patients. At this point, it may be possible to detect AD with certain memory and planning tests. Some recent studies (Bäckman & Small, 1998, 2007) convincingly demonstrated that the cognitive deficits of AD can be detected by some simple cognitive tests during a preclinical period spanning several years. This theory was also supported by numerous neuropathological, electrophysiological and neuroimaging studies, as the cognitive deficits in AD are related to a possible disconnection between cortical areas (Delbeuck et al, 2003).

In the present chapter, we introduced two tactile pattern delivery devices. The first device was designed to work under a Magnetic Resonance Imaging (MRI) environment for neuroimaging studies. The results of the evaluation experiment indicated that the performance of the device was unaffected by the magnetic field and that the...
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