Motor Skill Improvement Tool for Apraxia

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ABSTRACT

Apraxia is one of the cognitive defects that characterizes Alzheimer's disease. Despite its prevalence and importance for diagnosing Alzheimer's disease (AD), this has devoted little attention among research community. Apraxia was more common in the Alzheimer's disease (32.3%) than in both Subcortical Vascular Dementia (SVaD) (16.7%) and Mild Cognitive Impairment (MCI) (4.8%). The present study discusses a new experimental study on fine motor-skill learning in patients with dementia and Alzheimer's disease.

Prior studies found intact fine motor-learning capacities. Subsequently, it is elaborated how these intact learning abilities can be exploited in the patient's rehabilitation with respect to the variables day today practice and feedback. The article concludes that if training programs are adjusted to specific needs and abilities, older people with AD can (re)learn practical motor skills, which may enhance their autonomy in life.

CCS CONCEPTS

• Alzheimer's disease • Apraxia • Apraxia management

KEYWORDS

Apraxia, Alzheimer's, Dementia, Motor skills, Tool for Apraxia

1 Introduction

Apraxia is a shortage of voluntary motor skills in Alzheimer's disease. With the progression of AD, the ability to perform some daily activities such as brushing, bathing and dressing can be reduced. Activities such as walking and eating become more difficult in the late stages of the disease.

There are limited tools available in health sector for diagnosis and management of patients with Dementia/Alzheimer's and those are either verbal, or manual. Hence, with the advancement of computer literacy in community, introducing information technology to healthcare field is a task of utmost importance. Despite numerous attempts around the world, currently there is a lack of such tools for this purpose in Sri Lanka.

This research attempts to fill the above lacuna by presenting a physical tool and an online application for Motor skill related problems that will assist in improving the long-term disease outcome, assessing progression of disease diagnosing preclinical AD.

2 Literature Review

The clinical symptoms associated with Apraxia are the limb movements [2]. Which is usually described in terms of two main types: ideomotor apraxia refers, it is difficult to learn pantomime, such as cleaning teeth or combing hair; ideational apraxia describes the inability to perform complex sequences of activities in daily life, such as preparing a cup of tea [3].

Pantomime Production task can be used to evaluate the use of a symbolic gesture. For gestures using tools, participants do not touch or grasp the tool, but they should pretend to use the tool as if they are holding it. Most of the time the pantomime is performed in verbal instructions. In some studies, the demonstration depends on the visual presentation Where as in others, the participants must perform an imitative representation of tool images or representing an unattainable action (e.g., a piece of butter that must be spread on bread) [4]. According to literature, pathophysiologic processes that leads to AD starts decades, prior to the clinical diagnosis of AD dementia.

Since minor cognitive impairment and functional impairment may represent an early stage of AD, distinct from normal aging process, the long preclinical phase of AD provides a critical opportunity for potential intervention with disease-modifying therapy. The recognition that several noncognitive symptoms, such as motor impairment, predict the subsequent development of

AD suggests that noncognitive behaviors may serve as important phenotypic markers of preclinical AD.

3 Research Objective and Methodology

The main objective of the research is developed a physical tool which connect to an online application for Dementia /Alzheimer's patients to minimize the adverse effects of the Apraxia. It helps to improve balance and coordination of the patient by evaluating Activities in motor skill related problems. The outcome of this research study is to provide a low-cost solution to assist the clinical studies in local hospitals in Sri Lanka.

This system has two components; a web application and a hardware tool which is interconnected. The web application development is performed by using HTML 5, PHP, MySQL, Java Scripts languages. The hardware tool is Arduino based device which is made from interconnected Arduino modules. An electrical signal is supplied to a copper wire, where both ends of the copper wire relates to a different resister that makes different voltage signals. The Arduino circuits have programmed to gather these differentials as signals to assess patients fine motor skills.

The high-level architecture of the proposed tool is represented in figure 1. The care taker must register the patient and add all the personal data to the web application. It is a requirement for the caretaker to arrange a proper environment and mantel willingness for patient to work these motor related activities. Then system will automatically generate results after the sufficient numbers of attempts are done. The results are saved in online database where the doctors and care takers can view the results real-time. Doctors can analyze the results of each patient which will help in assisting the further treatments of the patient.
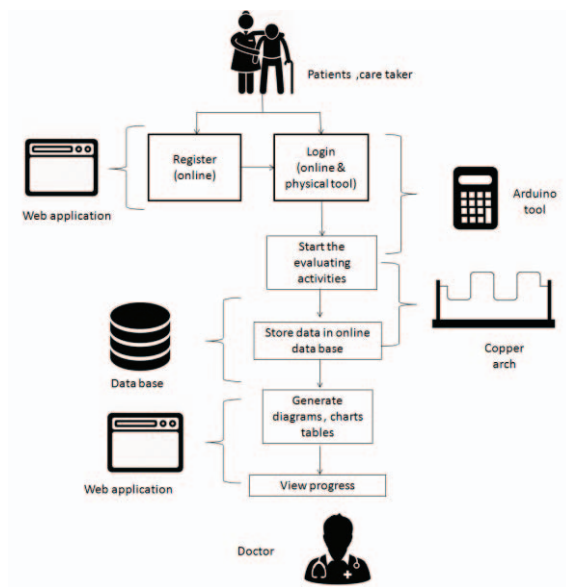
The researchers used 60 patients a as sample from Sri Jayewardenepura Teaching Hospital and Kandy Teaching Hospital in Sri Lanka for testing purposes. Furthermore, another sample of healthy individuals are taken to compare the significance in motor skill decline in Alzheimer's patents. Presently the research team performs testing the results to check the accuracy of the tool. The tool is testing clinically testing under the supervision of Dr. Harsha Gunasekera, Consultant Neurologist, Sri Jayewardenepura Teaching Hospital, Prof Ranil De Silva, Department of Anatomy, Faculty of Medical Sciences, University of Sri Jayewardenepura and Dr. Srikanth Srinivasan, Consultant Neurologist, Lanka Hospitals PLC.

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Figure 1: High level architecture diagram