Invention Holds The Promise Of Earlier, More Accurate Alzheimer's Detection

University of Glasgow

Diagnostic Potentials Ltd., a spin-off from the University of Glasgow, has completed a pivotal clinical trial demonstrating that the ADEPT System can detect Alzheimer's at an early stage. Coupling dense array EEG with a computer program designed to test patient's cognitive skills, this technology may revolutionize the way clinicians diagnose a degenerative and highly debilitating disease.

It looks like an elaborate hairnet, or a strange wig of wires, and those who place it on their heads work at a computer terminal. While it sounds like the setup for some kind of virtual reality game, in fact it is not.

> *This cutting-edge technology that may hold the key to the early and accurate diagnosis of a dreaded disease.*

Alzheimer's, a progressive and degenerative disease, continues to stymie clinicians, drain nations' economies and

shatter many lives. Currently, the diagnosis of early stage Alzheimer's dementia is difficult because affected individuals display symptoms that appear to be part of the normal aging process. Yet it is during the early phase in the disease's development that an accurate diagnosis would be most beneficial and allow for more effective intervention.

Diagnostic Potentials, located in Glasgow, Scotland, is on track to develop the missing diagnostic tool. A spin-off from the University of Glasgow's department of psychology, the company has gotten off the ground with the help of funding from United Kingdom government research trust funds. With the completion of the first clinical trial to evaluate its leading technology — the ADEPT system — the founders of Diagnostic Potentials are optimistic.

ADEPT uses EEG (electroencephalogram) to measure the electrical activity of the brain while an individual performs a set of computerized cognitive tasks designed to assess intellectual function. The goal of the technology is to identify differences in the electrical signals in individuals with fully functioning brain activity, and individuals exhibiting early stages of Alzheimer's. In the latter case, memory function becomes impaired and can be measured through changes in EEG patterns.

Chief scientific officer and co-founder of Diagnostic Potentials, Kerry Kilborn, Ph.D., says this technology is less invasive and claustrophobic than other forms of brain scans presently used to probe for signs of Alzheimer's. The EEG array sensor net is designed like a spongy hairnet and patients undergoing the test simply place it on their heads. The critical difference between the sensor net used with ADEPT and conventional EEG nets is the number of sensors used to measure brain activity — 128 rather than 12. This provides a tremendous advantage because by covering most of the upper brain, the dense array produces higher resolution maps of electrical fields on the scalp and can better capture brain function.

A Clinician's Dream

Alan Hughes, M.D., geriatric psychiatrist and honorary senior clinical lecturer at Inverclyde Royal Hospital in Greenock, Scotland, was involved in the first clinical trial of ADEPT. As a clinician who treats elderly patients, he understands the present limitations of diagnosing Alzheimer's and realizes how essential it is to make the proper diagnosis early in the disease when treatment is more effective.

"The most useful time of diagnosis, from the patients' point of view, is when they can do the most about their illness — when they can participate in decisions about their treatment, make their wishes known, and discuss them with family members," says Dr. Hughes.

Technically speaking, Dr. Hughes says the development of this technology is significant because current tools for Alzheimer's dementia such as computerized axial tomography (CAT) scans simply provide a picture of what the brain looks like at a specific time. An early stage Alzheimer's brain often looks the same as the brains of individuals affected with other diseases.

"This approach, looking at brain function, allows us to be more accurate and gives us more valuable information," he says.

Generous Help from the Public and Private Sectors

The transfer of the ADEPT technology from a psychology laboratory at the University of Glasgow initially presented some intellectual and financial challenges according to Professor Kilborn. Commercialization support from the Scottish Biomedical Research Trust and the Department of Trade and Industry for commercial, legal and intellectual property work were the critical components in the 1999 launch of Diagnostic Potentials. The Scottish Technology Fund, along

with private investors, helped the founders to raise £384,000 (approximately $618,000 U.S.) to commence the development phase of the company and support three full-time employees.

The fledgling company devoted the next two years to achieving the ADEPT technology's proof of concept while occupying a small space in the Scottish Enterprise research incubator. They reached their goal and filed for a patent by 2001.

Although buoyed by this breakthrough, the company faced an uphill battle over the next few years.

"We had used most of the funding that was raised by that time," recalls Professor Kilborn, "so we had to write a new business plan and attract more potential investors for a second round of funding."

Despite a real turndown in the market at that time, the company persevered and eventually found support from several sources — the Wellcome Trust Fund charity, Scottish Executive, and Scottish Enterprise — totaling over £800,000 (more than $1.3 million U.S.).

Kevin Cullen, Ph.D., director of research and enterprise for the University of Glasgow, points out that Diagnostic Potentials is an excellent example of how long it takes to move good university science out of the lab and into the marketplace.

"The story of Diagnostic Potentials demonstrates the process of university commercialization and how necessary it is to find those little pots of money to keep a project alive at times when the academics are under pressure," he says. "The process requires a highly motivated, enthusiastic and determined academic in a supportive academic environment to make it work."

With a second round of funding secured, Professor Kilborn and his colleagues focused on designing a full-scale clinical trial — one that necessitated rebuilding the ADEPT technology and software from the ground up. In the last several years they launched and completed the first multi-site clinical trial involving 148 patients at four different centers across the United Kingdom. Publication of the results is pending, and Professor Kilborn hints that they are promising.

The trials are demonstrating that the ADEPT technology can identify Alzheimer's disease in cases where it might not be easily diagnosed. Cullen is focusing on the trial's implications beyond the primary findings and expresses hope that the technology will be capable of mass applications — especially given our society's aging population.

"The ADEPT approach is creative, and from the commercial perspective, we hope to convince those in the company to look into other markets and explore other applications," he says.

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