Dr Claire Honeycutt introduces her work with stroke survivors, and her intentions to address some of the common complications they experience and improve intervention strategies.

How did you become interested in research aimed at supporting stroke patients?

I started out wanting to be a physician, however, during college I realised I wanted to not only treat patients, but also work to improve the methods by which we treat patients. I was particularly drawn to disorders of the nervous system because it is one of the most complex and least understood systems of the body.

I then ventured into research that ultimately led me to the Rehabilitation Institute of Chicago, where researchers work side by side with clinicians to improve quality of care and outcomes for patients. I am now moving to Arizona State University where I intend to establish the same types of collaborative research projects.

Could you introduce your work and its key objectives?

Someone has a stroke every minute in the US, making it the nation’s leading cause of serious, long-term disability. My primary research objective is to develop therapies and interventions that address two of the most common complications following stroke: falls and loss of arm function. It is hoped that this work will help enhance mobility and quality of life for stroke survivors, and see the development of effective fall prevention programmes and arm/hand rehabilitation therapies.

Are there any therapies in place for problems relating to upper extremity function?

There are numerous options targeting the improvement of upper extremity function including, but not limited to: bilateral training, neurophysiological approaches, electromyography biofeedback, electrostimulation, high-intensity therapy, mental practice, transcranial magnetic stimulation and transcranial direct current stimulation.

Despite all these options, a recent review in *Lancet Neurology* highlighted that only constraint-induced therapy shows robust improvement across a multitude of studies. Constraint-induced therapy consists of limiting the use of the non-paretic limb to improve function in the paretic limb through practice. While effective, it takes substantial time and cost to implement – particularly when the therapy is supervised by a clinician.

Regarding your work to prevent falls in stroke patients, what measures currently exist, and are there any promising new possibilities on the horizon?

Most current fall prevention programmes encompass either the elimination of potential fall hazards from an individual’s home or exercise training. In contrast, task-specific training, an emergent intervention, is designed to expose people to situations where they might fall, in a safe, controlled environment, where injury is not possible. As a result of this targeted approach we see faster improvements, making task-specific training an increasingly credible alternative intervention.
EVERY ORGAN IN the human body relies on blood to transport essential nutrients and oxygen in order to maintain normal function. When there is a disruption in the flow of blood to an organ, serious consequences can occur, and seldom are these consequences more serious than following a stroke, when the blood supply is cut off to part of the brain.

Around the world, approximately 15 million people suffer from a stroke each year, and one in six people globally will have a stroke over the course of their lifetime. The resulting damage can affect many different parts of the body as well as the ability to perform basic functions such as speaking and walking. The effects of stroke are typically long-lasting, and patients generally need to undergo long periods of rehabilitation.

One result of the impairment that follows a stroke is that patients are more prone to falls. In fact, this is the most common and expensive complication in survivors, with half of all stroke patients in the US experiencing a fall. One reason the number is so high is that 80 per cent of patients have difficulty using their upper limbs to perform reaching tasks as a result of muscle weakness following a stroke, making it difficult for them to balance themselves or to reach a stable object in order to prevent a fall.

Research initiated at the Rehabilitation Institute of Chicago and to be continued at Arizona State University is exploring alternative therapy options that can help prevent falls and improve mobility in the upper body for stroke patients.

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IMPROVING QUALITY OF LIFE

The main focus of Dr Claire Honeycutt’s research career so far has been understanding the complexities of falls and the loss of upper limb function in stroke patients. As she transitions into a new position at Arizona State University, her goal is to apply her past findings in order to create new therapeutic approaches and interventions to help stroke patients improve their mobility and enjoy a better quality of life.

This work will have long-lasting benefits for stroke survivors by contributing to the development of a new type of recovery programme that improves on the efficiency of current therapy options.

Current fall prevention therapies come up short in offering an optimal treatment plan. They often require a very lengthy investment of time – up to 12 weeks – and do not always translate into positive results under different settings. Most prevention programmes follow one of two routes: eliminating potential fall hazards from an individual’s home or exercise training. Honeycutt appreciates the benefits of these approaches, but feels both are somewhat limited: “The first option is generally successful, but once patients leave the comfort of their home they are often at greater risk of falling because they have not practised obstacle avoidance,” she notes. “The second option has shown some promise but the current consensus is that only exercise training, which includes balance and stability tasks, shows consistent success.”
An alternative approach to fall prevention therapy is known as task-specific training. As the name suggests, it involves patients being presented with situations where there is a real danger of falling, but in a controlled environment to ensure safety. This approach has mainly been tested on adults who are prone to falling but otherwise healthy, and the results so far have been promising, with people making noticeable improvements in half the time of other prevention therapies. Crucially for Honeycutt and her fellow researchers, improvements achieved during task-specific training in the laboratory were found to translate into different settings where falls can occur. For example, fall-prone older women who received task-specific training on the treadmill showed decreased incidence of falls out in their community. Building on this success, the next step is to adapt this approach to take into account the needs of stroke patients by better understanding the mechanisms that contribute to their falls.

A BALANCING ACT

One avenue that Honeycutt is investigating to improve therapy for stroke patients involves compensatory limb movements. These are instinctive movements that a person makes when they are about to fall, such as reaching for a stable object or taking a step to balance. “It turns out these compensatory limb movements are fundamental to avoiding a fall,” Honeycutt reveals. “In fact, previous research indicates that the first step during balance disturbance is critical to a successful recovery and avoidance.”

Even though these movements are shown to play a major part in stopping a stumble from turning into a fall, people who undergo task-specific training are generally advised not to make compensatory movements to catch themselves. Knowing the importance of these movements, Honeycutt is seeking to find out more about what drives them, an area that has been studied very little to date. She has proposed the novel hypothesis that these movements are driven by an involuntary reflex termed the startle reflex, and thinks that a greater understanding of this mechanism may help medical workers improve compensatory movements in individuals with impairments.

STARTLING INSIGHTS

The startle reflex is a common involuntary action that people experience when a surprising stimulus causes the body to flinch in response. What is interesting about this reflex for Honeycutt’s research is that if a person is preparing to extend their arm, for example, and they are startled, the brainstem will send a message causing the person to reach out their arm rather than just flinching.

While the part of the brain that controls arm and hand movements is often damaged in stroke patients, the brainstem is typically spared, and Honeycutt saw this as an opportunity for treatment. “We can use the startle reflex to initiate movement through the brainstem,” she explains. “This allows us to evaluate the capacity of stroke survivors to plan movement. It is also something we can use to monitor an individual’s learning while they are going through therapy and training.”

A VACCINE AGAINST FALLS

Ultimately, Honeycutt hopes that her work will have long-lasting benefits for stroke survivors by contributing to the development of a new type of recovery programme that improves on the efficiency of current therapy options. As she begins work at her new institution, Honeycutt will spread these ideas further and intends to see them being taken up by the wider population of stroke specialists and patients.

Interestingly, the knowledge gained from these studies of stroke survivors could also help to improve the quality of life for patients with other conditions that affect mobility, such as Parkinson’s disease or cerebral palsy. “In the long term we hope to develop a therapy programme that individuals can complete at the clinic or possibly even at their own gym,” Honeycutt enthuses. “Eventually, we hope that this treatment will act as a ‘vaccine’ against falls.”