

## OUTSIDE JEB

### Big consequences of small changes for stroke sufferers



For many stroke victims, the road to recovery is often a gruelling mental and physical challenge. During a stroke, the affected area of the brain is starved of blood, and therefore oxygen, causing the surrounding tissue to die within minutes, which can leave the patient with a variety of motor problems. One common post-stroke condition is weakness or paralysis down one side of the body, often leading to walking difficulties. Individuals with such problems are at higher risk of tripping during walking and the resulting injuries can lead to further setbacks in their rehabilitation and mental health.

Understanding the potential biomechanical causes of these stumbles would be highly valuable to those designing rehabilitation plans for stroke victims and could prevent fall-related injuries. Gait changes such as slower walking speeds and asymmetrical movements between the paretic (affected with paralysis) and non-paretic leg have been identified, but the biomechanical characteristics of a naturally occurring trip were previously unknown.

With this in mind, Jessica Burpee and Michael Lewek, from the University of North Carolina at Chapel Hill, USA, decided to investigate the biomechanics of the lower limb in stroke patients. They wanted to know whether there were differences between the affected and unaffected legs during unsuccessful steps, which might begin to explain

exactly how these missteps occur. To do so, the authors analysed the leg joint movements of 26 patients recovering from stroke while they walked unaided on a treadmill, tethered with a harness to prevent them from falling when they tripped. The duo attached markers to the pelvis, legs and feet of each participant and filmed them with eight cameras while they walked at comfortable speeds. Using the markers, they then modelled each individual's three-dimensional motion and calculated the joint angles at the hip, knee and ankle during both normal walking and when they stumbled.

In steps that resulted in a trip, the scientists found a number of small but significant biomechanical changes in the lower part of the leg affected by the stroke; in particular, just as the foot leaves the ground. During this period in unsuccessful steps, the knee of the stroke-affected leg bends more slowly and the ankle is at a higher angle, so the toes are more pointed towards the floor. Though these differences are seemingly trivial by themselves, together they create a functionally longer limb, resulting in a stumble when the stroke-affected foot does not clear the ground successfully when stepping. Interestingly, there appeared to be no significant biomechanical changes in the upper leg that would also cause a more extended limb.

These results highlight characteristic biomechanical patterns during trip steps that span multiple joints of the lower limb. Currently, ankle-foot orthoses are often used during stroke recovery to aid stability and foot clearance during walking, but this targets only a single joint. This work suggests that, in fact, treatments addressing multiple joints would increase the success of rehabilitation, preventing trips and falls.

For chronic stroke victims, each successful step is a small victory. Studies like this help to increase our knowledge of the effects of stroke, and in turn the patients' physical and mental strength, one step at a time.

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### A crow's lesson in death



Humans have always had an uneasy relationship with crows. While admired for their legendary intelligence, they are also despised as agricultural pests and feared as harbingers of death – human death, that is. But what about crow death? Here too, crow behaviors have long puzzled and fascinated. Draped in black, crows attend funerals for fallen conspecifics. Is it because they are simply morose? Or might it be that dead crows can still speak to the living, silently imparting wisdom from the grave about the manner and context of their demise?

To address these issues, Kaili Swift and John Marzluff from the University of Washington, USA, carried out a series of experiments that are as clever as they are creepy. First, to gain the trust of breeding pairs of crows, Swift plied the birds with a favorite snack of peanuts and cheese puffs. Then, a few days later and in sight of the resident pair, volunteers in expressionless facemasks showed up next to the food pile carrying dead taxidermy-stuffed crows in their outstretched hands! As if this weren't traumatic enough (to both crows and people alike), these macabre scenes were sometimes paired with a stuffed