There were approximately 65,000 Australians living with Parkinson’s Disease in 2011 and with an increasing rate of incidence this is projected to increase to 115,000 by 2031. Parkinson’s disease is a degenerative disease due to a loss of dopaminergic neurones in the brain. It produces a movement disorder and in later stages also affects cognition. There is no cure, and while there are treatments that alleviate the symptoms, these can have severe side effects. The motor symptoms of Parkinson’s disease are well known. Patients often suffer from tremor, rigidity of their muscles and bradykinesia, a “slowness of movement,” in which patients have trouble with fine movement control and initiating movements. What is less commonly known is that Parkinson’s disease patients also suffer deficits in their proprioception.

Proprioception can be considered the sense of our own actions. It provides the brain with the information it needs to control movement. Proprioception includes a sense of limb position and movement, a sense of the force generated by our muscles, and a sense of the motor effort needed to generate that force. Proprioception is often taken for granted; most people do not even know it exists. However, the importance of proprioception to movement control becomes obvious when it is disrupted or lost and normal movement is no longer possible. If you close your eyes, you still know where your arms and legs are, and you can still touch the tip of your nose with you finger. You could not do this without proprioception.

Control of muscle force is impaired in Parkinson’s disease patients. It affects movements made voluntarily as well as mostly ‘automatic’ movements such as walking. Parkinson’s patients are less able to detect the size of the loads they bear and suffer an impaired ability to detect small movements of their joints. One consequence of these proprioceptive deficits is that Parkinson’s disease patients rely more on their vision to control movement, including walking. Then if vision is impaired, movement is more difficult and the risk of falling is increased. Furthermore, someone focusing on their walking will be less aware of their immediate surrounding and any approaching hazards. Currently the proprioceptive disruptions seen in Parkinson’s disease cannot be alleviated by therapy. Therapy may even make things worse. Even if other motor symptoms are resolved, without restoring proprioception normal movement cannot be achieved. Furthermore, without understanding the effects of Parkinson’s disease on proprioception, we cannot fully understand the disease.

Patients with bradykinesia will sometimes have periods of immobility or freezing. When this occurs during walking it is referred to as freezing of gait. Here patients experience short episodes of immobility and report that their feet are stuck to the floor, despite a continued effort to move them. These freezes occur most often during the start of walking or turning. In addition, Parkinson’s disease patients suffer a distortion in their sense of motor effort. Abnormalities in the sense of effort and the relation between effort and movement are a common observation, but it is not known how this impacts wider proprioception and movement control.

Disruptions of proprioception can appear very early in Parkinson’s disease, and may appear before motor symptoms. Detecting and measuring these changes in proprioception may help...
early detection and improve therapy. Unfortunately, the current clinical tests are not adequate for detecting these distortions\(^3\). Early detection of these proprioceptive deficits requires the development of more sensitive clinical tests.

References: