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Gut feeling the wait for relief may be over

Parkinson's disease may have met its match and from an unlikely source.

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Ron Till, 69, was exhausted. For two years he had lost the ability to have a good night's sleep. He would go to bed early, only to be woken by his body jerking violently, one of his many symptoms of Parkinson's disease.

But things changed for the better when he signed up for a clinical trial assessing the effectiveness of infra-red light therapy for Parkinson's sufferers.

"It improved my sleep so much," Till, who lives in Mannum, South Australia, says.

Within weeks of starting the trial, which involved applying infra-red light therapy to his head and abdomen, three times a week for 12 weeks, he stopped jerking awake. “I got back my two blocks of four-hour sleep, which is like gold to me,” Till says.

He was so pleased with his improvement that once the study ended Till purchased a light helmet device used in the trial, and continues to use it for 20 minutes every second day.

“Sometimes I forget to bring it when I go to visit my brother in Robe,” Till says, “and my sleep goes downhill fast.”

Till credits his ongoing use of light therapy for preventing his Parkinson’s symptoms from getting worse. “Since I started the light treatment I’ve plateaued so nicely that my neurologist has reduced my three monthly visits to yearly.”

The results of the peer-reviewed trial that involved 19 participants in NSW and SA, showed that Till was not an isolated case – most demonstrating improvements in Parkinson’s symptoms including gait, balance, cognition and fine motor skills after receiving infra-red light therapy.

In addition, the trial examined for, and found, changes in the vast numbers of bacteria, protozoa and fungi that are normally present in the gastrointestinal tract – known as the gut microbiome. That changes were found in the participants’ gut microbiome meant that this was the first known trial worldwide to demonstrate changes in the human gut microbiome following infra-red light therapy.

Brian Bicknell, microbiologist and lecturer at the Australian Catholic University, says he came up with the idea during a discussion in 2016 with colleagues about why a monkey previously involved in an experiment on Parkinson's disease, would show improvement in symptoms after receiving infra-red light therapy only to its abdomen.

"I suggested it was probably the microbiome," Dr Bicknell says. "The gut microbiome seems to be incredibly important to our own overall health."

Breakthrough hope

The Australian study's microbiome findings, which are being published in The Journal of Photochemistry & Photobiology, B: Biology, offer a potential ray of hope for about 80,000 Australians and 10 million people worldwide who are facing a long, slow decline from a progressive neurodegenerative disease for which treatment options are limited.

The number of cells in the gut microbiome is estimated to be more than 100 trillion, which is as many as the number of cells in the rest of our entire body.

There has been increased interest in the gut microbiome over recent years, with an unbalanced microbiome linked to a number of medical disorders, including neurodegenerative disease, cardiovascular disease, asthma, diabetes, irritable bowel syndrome, inflammatory bowel disease, colorectal cancer and obesity.

There has long been a postulated link between Parkinson's disease, the gastrointestinal tract and the gut microbiome. The gut microbiome in Parkinson's patients has been shown to be altered compared to those of the general population.

Constipation affects 90 per cent of Parkinson's sufferers, often preceding the initial diagnosis by many years, and there is an increased risk of Parkinson's disease in those who already have IBS or IBD.

The reason for this link is undetermined, however the prime suspect is a protein known as alpha-synuclein. Abnormal accumulations of this protein in nerve cells form microscopically visible lesions known as Lewy bodies, which are associated with a decreased ability to repair the DNA damage and increased cell death.

Lewy bodies have been detected in the gastrointestinal tract up to 20 years before the diagnosis of Parkinson's disease. They are also present in high numbers in the brain of Parkinson's patients.

It is thought that inflammation leads to increased alpha synuclein accumulation in the gastrointestinal tract, with some of this excess being transported to the brain via the vagus nerve.

This hypothesis is supported by the fact that those who have undergone a surgical transection of the vagus nerve — that starts at the brain stem and travels down the body to supply the stomach, small and large intestine — are less likely to develop Parkinson's disease.

Improvements in the gut microbiome may reduce gastrointestinal tract inflammation and permeability, which would reduce alpha-synuclein transportation to the brain, as well as increase the beneficial microbial metabolic by-products, such as serotonin, GABA and dopamine, thereby reducing the risk of Parkinson's and improving symptoms in those who already have the disease.

From mice to humans

Australasian Research Institute's Ann Liebert and her colleagues had already found through earlier research that the gut microbiome of mice could be altered through administration of infra-red light therapy. They wished to see if this finding could be replicated in humans.

Nineteen volunteers with Parkinson's disease from NSW and SA were recruited. All participants were aged between 60–80 and had mild to moderate symptoms and signs of Parkinson's.

The participants gave a faecal sample to researchers before the trial began and were asked not to alter their dietary habits or day-to-day activities during the duration of the study.

The participants were then given infra-red light therapy via laser devices to their abdomen at a wavelength of 904-nanometres, and to their head at a wavelength of 810-nanometres and/or their neck at a wavelength of 904-nanometres, three times a week for 12 weeks. At the end of the 12 weeks a further faecal sample was

collected from each participant and the microbiome from each of these faecal samples were analysed via DNA extraction and testing.

Eureka moment

“It was incredibly exciting to see changes in the microbiome and improvements in symptoms happening at the same time,” Dr Liebert says.

“Even more exciting when we saw the same kind of changes in the Sydney trial where we treated the abdomen only.”

The majority of participants showed a significant increase in 10 different genera of microorganisms including bacteroids, alistipes and prevotella and a significant decrease in 17 different genera including bifidobacterium, streptococcus and various clostridium and enterococcaceae genera.

Interestingly two of the bacterium that showed an increase – bacteroids and prevotella – have been shown in multiple studies to be reduced in the gut microbiome of Parkinson’s sufferers. In fact low levels of prevotella are so strongly associated with a more rapid progression and greater severity of Parkinson’s that it has been proposed as a biomarker for the disease, while bacteroids are considered beneficial to the microbiome through their anti-inflammatory properties and production of healthy short chain fatty acids.

Five of the bacteria that showed a decrease post light therapy – bifidobacterium, streptococcus, lactobacillus, christensenella and enterococcaceae – have been

shown in multiple studies to be increased in the microbiome of Parkinson's sufferers.

Several of the bacteria are generally considered detrimental to the microbiome. Enterobacteriaceae is thought to decrease gut integrity and produce pro-inflammatory metabolites; Clostridium genera are associated with high fat diets and Type 2 diabetes; and streptococcus is considered to be potentially pathogenic.

"It is quite possible that laser will provide a synergistic effect to the currently available therapeutic manoeuvres (to the gut microbiome)," Professor of Cardiology at Macquarie University Hosen Kiat says. "It is a no-brainer if it is useful because it is relatively cheap, it is non-invasive and it has zero side effects."

Surprise discoveries

Not all the microbiome findings were as expected. Both lactobacillus and bifidobacterium are considered to be beneficial to the microbiome, yet both bacteria showed a significant decrease in the majority of participants following light therapy.

"We know that very few diseases have a magic bullet treatment," Professor Kiat says. "I don't want to overall any technology in its infancy. But if I were a Parkinson's patient I would seek out the laser and I would use the same protocol as we described."

Despite these uncertainties, one of the trial's participants, Margaret Jarrett, 75, is convinced of light therapy's benefits. As an avid flower gardener at her Adelaide

home, she was dismayed when she developed anosmia (loss of smell) as a result of her Parkinson's.

After several weeks of therapy, she regained her sense of smell. "It's amazing, you go outside and I suddenly smell the perfume of murraya in full bloom," she says.

Jarrett noted another improvement post therapy. For years she had been plagued with debilitating irritable bowel syndrome. "I never knew what the morning would be like," Jarrett says. "I like to get up early and go for a walk and sometimes I would get caught short."

Interestingly, two bacteria that have been found to be elevated in IBS, dorea and enterococcaceae, decreased post light therapy in Liebert's trial. "The laser has really helped me not to have diarrhoea," Jarrett, who continues to administer light therapy via a handheld device to her abdomen three times a week, says.

David Harrison, 62, from Sydney, is another trial participant. Diagnosed with Parkinson's disease in his mid-50s, Harrison's symptoms had become so severe that he was having to use his left hand for most tasks.

"Eight weeks after starting laser therapy I was driving myself home and I suddenly realised I was right-handed again," Harrison says.

Post-trial Harrison purchased a handheld laser device and also continues to use it three times a week. "I still take my medications for Parkinson's, I think it's prudent

to do that," he said. "But I use the light therapy as well. I'm doing everything I can to beat Parkinson's."

It is impossible at this stage to know whether the improvements in the Parkinson's symptoms of the trial participants were due to the effect of infra-red light therapy to the brain, or due to changes in the gut microbiome, or partially due to a placebo effect, or, most likely, a combination of the above.

What is unquestioned is that exposure to light therapy did alter the gut microbiome, seemingly for the better, and that further research in this area is urgently needed.

With his Parkinson's symptoms in check, Till plans to do more travelling. "I have family up on the Gold Coast, and I think to myself, 'Can I drive that far?' Before it was impossible but now I think, 'Perhaps I can.'"

As for Jarrett, she has some important advice for others who may have Parkinson's disease diagnosed.

"Don't despair and don't panic," she says. "Be open-minded about adjunctive therapies and get a good team to support you. When I was first diagnosed with Parkinson's I said to my doctor, 'It's not going to get me. I'm going out to meet it.'"