

The Idea Behind Using Masked 40 Hz, Light Based Brain Stimulation for Alzheimer Disease

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Article



Marcus Carstensen, PhD candidate, CTO and co-founder of OptoCeutics in Copenhagen, Denmark, talked about the mechanisms of using noninvasive light technologies for Alzheimer disease treatment.



Marcus Carstensen, PhD Candidate

Despite the recent approval of potential drugs targeting novel treatments for Alzheimer disease (AD) such as lecanemab (Leqembi; Eisai) in the United States, there remains a lack of novel treatments for AD. Prior research confirmed an increase of fast brain oscillations using [gamma sensory stimulation](#) at 40 Hz to potentially impact AD-related cognitive decline and neuropathological processes.¹ Thus, tools with gamma stimulation present as promising therapies for patients with AD.

Recent research from a phase 1 study (ALZLIGHT S1 and S2, NCT04574921), led by Zealand University Hospital in Denmark, demonstrated that 40 Hz stimulation with a light therapy system (similar to the commercialized product, EVY LIGHT, by OptoCeutics ApS) is safe with a high feasibility user adherence in patients with mild to moderate AD. ALZLIGHT S1 included 5 healthy controls while S2 included 11 patients with mild to moderate AD. In the healthy control group, the adherence rate was 89.8% (ALZLIGHT S1; treatment, 86.1%; placebo, 95.4%) versus rates of 94.0% in patients with mild to moderate AD (treatment, 97.9%; placebo, 90.1%).

Recently, Marcus Carstensen, PhD candidate, chief technology officer and co-founder of OptoCeutics, spoke with *NeurologyLive*[®] about the company's light stimulation therapy device for AD. In addition, he discussed the technical science behind masking the light and how it can be used on a day to day basis for this patient population. Carstensen also

discussed findings that were presented at the [2022 Clinical Trials on Alzheimer's Disease \(CTAD\) conference](#), November 29 to December 2, 2022, in San Francisco, California.

NeurologyLive® : What is the background behind your company's intervention for Alzheimer disease light therapy?

Five years ago, I went into neuroscience and started our medical device startup with Mai Nguyen, the CEO of OptoCeutics, based in central Copenhagen. I think I've always had an interest in the brain. The purpose in neuroscience, as in physics, is the same. It's trying to find out what is going on. You can either go big to expand the understanding of space or you can go narrow, and try to understand the brain, things at the neuron level or the quantum level. We see ourselves as co-pioneering this idea about having a gamma society, meaning creating a society where our artificial light sources have health benefits. We can use light to basically synchronize the brain and reduce the amount of plaques, amyloid beta and tau. This is a technology that can be scaled up and help a lot of people compared to pharmaceuticals. The drugs within pharma tend to have a pretty high price and tend to not get approved in Europe. But, this is a very scalable technology that can reach a lot of people and have a lot of impact on day to day life.

A lot has happened in 5 years. We are now in a phase 2 clinical trial pursuing the indication of treatment of mild to moderate Alzheimer disease. We have good clinical phase 1 results and our safety data has been presented at CTAD.

We have recruited the first 7 participants in our phase 2 study and will hopefully have the results of that study sometime in 2025.

What are the technical functions of using the light?

Back in 2017, the first thing we did is make a strobe light at 40 Hz, and exposed ourselves to the light. The immediate reaction we had was, 'it is interesting that it works.' It's not super uncomfortable, but it became difficult to use this light. At the same time, there were 2 professors from DTU and 2 scientists from UC Berkeley who were exploring the idea of masking the light and making it static so that it was substantially less perceivable.

They were not sure exactly how to do that, so they asked for my help to do this. We went in and built the first prototype in 3 weeks and supported the IP process of getting the patent filed. Essentially, in 3 weeks, we tried to make light that appears like a disco ball—a

very uncomfortable flickering—into something that appears continuous, smooth, and is perceived as comfortable. You definitely want a light that has a more static and comfortable experience, while keeping the healthy benefits for the brain. We essentially developed a technology that is modular, and it can potentially be built into this idea about creating a gamma society.

Can you provide details on the study you presented at CTAD 2022 using your gamma light intervention?

We presented preliminary results from the phase 1 randomized controlled trial on the safety and feasibility of light-based brain stimulation with 40 Hz, invisible spectral flickering light, in patients with mild to moderate Alzheimer disease. It's a small study where 11 participants were randomized into 2 arms of either placebo or treatment, and received 6 weeks of intervention, followed by 6 weeks of no intervention. It's an investigator-initiated study, not initiated by the sponsor, so in that way it's less biased. We reported a very high adherence among patients who used our product, and we saw that 94% of the time that they were prescribed to use it, they used it. We measured adherence to the device with an eye tracking camera. With the device, you know exactly where they're looking within a field of view to get stimulation.

In the study, the participants were required to use it for 1 hour a day for 6 weeks. Of those 6 weeks, patients used it 94% of the time correctly. That means, on average, people are using it above 50 minutes per day, every single day for 6 weeks, and that is a big accomplishment. People really do like to use it. Imagine exercising for 1 hour a day; that's a pretty difficult habit. Being able to do something consistently in your life is very difficult for anyone, even if you're super ambitious with your habit generation. It's pretty stunning that they have used it for that long of a period so consistently.

Transcript edited for clarity.

REFERENCES

- 1. Manippa V, Palmisano A, Filardi M, et al. An update on the use of gamma (multi)sensory stimulation for Alzheimer's disease treatment. *Front Aging Neurosci.* 2022;14:1095081. Published online December 15, 2022. doi:10.3389/fnagi.2022.1095081**
- 2. Agger M, Carstensen, Horning, M, et al. ALZLIGHT pilot: Preliminary report on safety and feasibility from a randomized controlled trial of light-based brain stimulation with 40 Hz invisible spectral flickering light in patients with mild-to moderate- Alzheimer's disease. Presented at: 2022 CTAD Conference. November 29-December 2, 2022; San Francisco, CA. Abstract P28**