Increased Improvement in Speech-Language Skills After Transcranial Photobiomodulation Plus Speech-Language Therapy, Compared to Speech-Language Therapy Alone: Case Report with Aphasia

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ABSTRACT:

Objective: This is a case report showing that transcranial photobiomodulation (tPBM) combined with traditional, speech-language therapy improved and accelerated the results from speech-language therapy, in a stroke person with aphasia (PWA).

Background: tPBM is a safe, non-invasive technique using red and near-infrared light to improve the metabolism of cells. tPBM helps by promoting neuromodulation, while decreasing neuroinflammation and promoting vasodilation. Several studies have shown that tPBM can help individuals with stroke or traumatic brain injury achieve significant cognitive improvements.

Method: A 38-year-old female, who sustained an ischemic stroke on the left side of the brain, received two, 5-month series of treatments. The first series of treatments included traditional speech-language therapy, for the first five months post-stroke. The second series of treatments included tPBM in combination with speech-language therapy, for the next five months. The tPBM treatments included application of red (630 and 660 nm) and near-infrared (850nm) wavelengths of photons applied to left hemisphere scalp areas. The major cortical language areas were subjacent to the scalp placements along the line of the Sylvian fissure. At each session, first an LED cluster head with red (630 and 660nm), and near-infrared (850nm) wavelengths, with an irradiance (power density) of 200mW/cm2, a beam size of 4.9 cm2 , and a fluence (energy density) of 12 J/cm2 per minute, was applied to the left side of the scalp/brain, along the Sylvian fissure for 60 seconds at each at the following eight, language network target areas: frontal pole, prefrontal cortex, inferior frontal gyrus (Broca's area); supramarginal gyrus and angular gyrus in the parietal lobe; inferior motor/sensory cortex (mouth area); posterior superior temporal gyrus (Wernicke's area) and superior temporal sulcus in the temporal lobe, for a total of 8 minutes. Second, for the next 20 minutes (1,200 seconds), simultaneous with speech-language therapy, an LED PBM helmet was applied to the scalp/head. This helmet contained 256 separate LED lights, near-infrared (810nm) wavelength, 60mW power per LED light, total power, 15W; energy, 72 Joules; fluence, 28.8 J/cm2 ; irradiance, 24 mW/cm2.

Results-Conclusion: During the initial, 5-month treatment series with traditional speech-language therapy only, there was little to no improvement in dysarthria and expressive language. During the second, 5- month treatment series, however, with tPBM applied first, to the left hemisphere only, and second, to both hemispheres during each session plus simultaneous speech-language therapy, there was marked improvement in the dysarthria and expressive language.

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After the first 5- month series, this PWA had utilized a slow rate of speech with a production of approximately 25-30 words-per-minute during conversations and spontaneous speech. Utterance length was only 4-6 words with simple, grammatical structure. After the second, 5-month series of treatment combining tPBM plus speech-language therapy, the rate of speech increased to 80+ words-per-minute and utterance length was increased to 9-10 words, with more complex grammatical structure.

Keywords: Speech-Language Therapy; Aphasia; Low-Level Laser Therapy (LLLT); Photobiomodulation (PBM).

Conflicts of Interest Statement
The authors declare no conflict of interest.