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Combined transcranial direct current and transorbital alternated current stimulations improve visual function in a case of bilateral optic atrophy

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OBJECTIVES

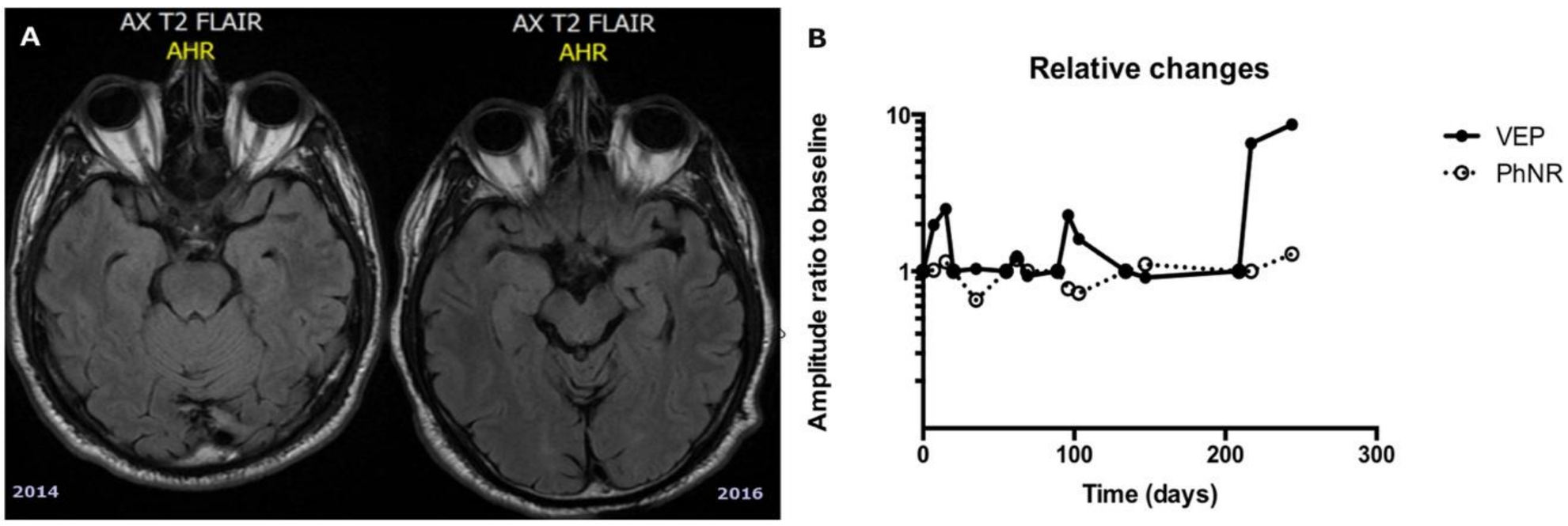
We present the results of a combined approach of tDCS and trACS in an insulin-dependent diabetic patient, with bilateral optic atrophy and severe visual deficit resulting from acute bilateral Non-Arteritic Anterior Ischemic Optic Neuropathy (NAION).

MATERIALS AND METHODS

A 47-year-old male was evaluated one year after suffering from an acute episode of bilateral NAION during diabetic coma. He had no light perception in both eyes. An optic atrophy was documented on both ophthalmoscopy and brain MRI.

A two-channels, dual mode tDCs stimulation was delivered using four 5x5 cm2 saline-soaked sponge electrodes connected to a battery driven stimulator (NeuroConn GmbH, Germany) with anodal electrodes were placed in O1 and O2 position. A two channel trACs was applied with the same electrical stimulator by placing the two active stimulation electrodes (10 mm diameter gold cup electrodes) over the eyeballs. Both tDCS and trACS were performed for 10 consecutive days, 20 minutes per day. tDCS was performed immediately before rtACs.

The patient underwent 5 cycles of combined tDCS and trACS stimulation. The interval between each cycle was between one and three months. Before and after any cycle of stimulation, the patient underwent to a clinical and neurophysiological evaluation with flash visual evoked potentials (VEPs) and electroretinogram (ERG) with measurement of photopic negative response (PhNR)



1a: MRI showing bilateral optic nerve atrophy at the onset of pathology. 1b: VEP and ERG after treatments with tDCS and trACS. VEP and ERG (photopic negative response - PhNR) potentials increase following treatment

RESULTS

There was a transient increase of VEP amplitude in comparison to baseline that reached almost a factor of 10 after the last stimulating session. There was also a minor, and less consistent increase of PhNR amplitude. After each cycle of stimulation, the patient reported bilateral phosphenes and increased background brightness, without flicker or form recognition, following each session

DISCUSSION AND CONCLUSION

In our case, a combined approach of tDCS and trACS was able to improve transiently, from a neuro-physiological point of view, the visual function in a blind patient with severe optic atrophy.

As previous study demonstrated that this transient improvement is not observed in normal subjects, it should not be considered as a naturally occurring fluctuation.

The neuro-physiological results suggest that a combined approach of tDCS and trACS could be promising for future clinical trials including patients with mild to moderate deficits. The increase of PhNR amplitude following the treatment suggest that one of the underlining mechanism of trACS effect could be the increase of retinal excitability.

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