Anodal tDCS decreases total EEG power at rest and alters brain signaling during fatigue in high performance athletes

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Background

• It is known that anodal tDCS over motor cortex can alter motor output.
• Intense interest surrounding the role of tDCS in high performance sports.

Two preliminary questions:
1. Will anodal tDCS affect observed EEG in athletes?
2. Can anodal tDCS improve athletic performance in endurance athletes?

Methods

• Four endurance athletes
• Specialized fatiguing protocol under comprehensive neurological and physiological monitoring

Cardiopulmonary Function Testing:
- Cardiac Hemodynamics
- Metabolic performance
- Respiratory response metrics

Brain Function Testing:
- Electrophysiological activity
- Transcranial DC Stimulation
- Transcranial Magnetic Stimulation
- Rating of Perceived Exertion
- Task Effort Awareness

Muscle Function Testing:
- EMG
- Periferal Nerve Stimulation
- Max. Blood chemistry
- Isometric force output
- Performance output

Baseline physiology and recovery status
- Max. Blood chemistry
- Lambert’s submaximal cycling test
- Heart rate variability during sleep
- Hydration markers
- Body Composition

Neurological and physiological metrics tracked on each athlete.

Anodal tDCS was applied to 4 athletes over 3 days in a single-blind protocol. Subjects received 20 minutes of either real (1mA Cz Anodal, FPz return) or sham tDCS according to a randomly generated schedule.

Results

• We recorded EEG signal from eight channels across the scalp throughout the protocol
• Although movement artifact disrupted much of the signal during static cycling, during the MVC periods clean recordings were possible
• We performed moving window; multi-taper spectral analysis to monitor total spectral power across different conditions

Conclusions

• These findings suggest that tDCS to motor cortex significantly alters the resting state of the brain, and the way in which the brain responds to fatiguing exercises.
• We have also presented evidence that suggests that tDCS also influences peripheral function.
• We did not find evidence that a single dose of anodal tDCS to motor cortex could enhance motor performance in athletes.
• Further research is required isolate the potential benefits of this protocols in the high performance environment.