Transcutaneous vagus nerve stimulation has no impact on the pupillary light reflex in healthy volunteers

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1 Introduction

Transcutaneous vagus nerve stimulation (t-VNS) is a new treatment option in drug-resistant epilepsy, depression and pain. t-VNS bases upon the topographic anatomy of the auricular branch of the vagus nerve in the concha of the human ear in order to gain non-invasive access to the vagal system [1]. Stimulation of the vagus nerve is known to activate the nucleus of the solitary tract [2] and, subsequently, the locus coeruleus which is involved in the modulation of the pupil diameter [3]. Vagus nerve stimulation in rodents evoked pupil dilation [4]. The present study addresses the possible impact of t-VNS on the pupillary light reflex (PLR) in man. It was hypothesized that t-VNS does not elicit persistent changes of the pupillomotor function.

2 Methods

• Randomized, single-blinded, crossover study
• 33 healthy volunteers: 16♀, 17♂, 24.8 ± 5.3 years
• Transcutaneous vagus nerve stimulation, t-VNS - applied to skin afferents of the auricular branch of the vagus nerve in left ear’s cymba concha.
  - electrical, rectangular pulses (250 µs duration).
  - intensity above detection threshold and below pain threshold evoking tingling sensations.
• 3 randomized sessions with varying conditioning stimulations on different days:
  - active t-VNS (25 Hz)
  - active control (1 Hz)
  - sham (no t-VNS)

3 Results

PLR did not change during conditioning stimulation

No difference in initial pupil diameter

Friedman ANOVA, not significant

No difference in contraction velocity

Friedman ANOVA, not significant

No difference in amplitude

3 randomized sessions with varying conditioning stimulations on different days: active t-VNS (25 Hz), active control (1 Hz), sham (no t-VNS)

4 Summary & Conclusions

• Invasive VNS in rodents evokes pupil dilation.
• t-VNS has no impact on the PLR in man.
• t-VNS does not affect the pupil accommodation ability.
• Side effects concerning the pupillomotor function during t-VNS are considered as unlikely.
• t-VNS is a safe treatment alternative in drug-resistant epilepsy, depression and pain.

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