ICHANGES IN VEP INDICES OF CORTICAL LATERAL INTERACTIONS WITH EPILEPSY TREATMENT

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PURPOSE

Vagus nerve stimulation (VNS) is a neurostimulation therapy for refractory epilepsy. The purpose of this study was to determine the effects of long-term VNS treatment on cortical lateral interactions reflected in the steady-state VEPs, and to compare these effects with those previously seen in epilepsy patients treated with gabapentin. Both treatments are believed to modulate cortical GABAergic inhibition.

METHODS

VNS PATIENTS - 11 patients with epilepsy. All had clinical benefit with VNS treatment (mean age: 39 yrs).

Inclusion Criteria
- Seizures within 24 hrs prior to VEP testing
- Evidence of occipital lesions on imaging studies
- Ophthalmological disease that might affect VEPs

CONTROLS - 22 age-matched normal subjects (15M, 7F; mean age: 34 yrs).

STIMULI - These consisted of contrast-reversal checkerboards and the radial windmill/dartboard pattern (Zemon & Ratliff, 1992) shown on the right. Modulation rate: 4.19 Hz. Contrast:0.3. Binocular viewing at 1 m. Field size: 8.8 x 8.8 deg.

The modulated regions are identical in the W/D-ON and W/D-OFF configurations, but the static region is present only in the W/D-ON configuration. Thus, interactions between these regions may result in differences between the VEPs that the two stimuli elicit.

PROCEDURE - For the patients, single channel OZ-Cz grnd mastoid steady-state VEPs were recorded with the VNS stimulator on (STIM-ON) and off (STIM-OFF) in recording sessions separated by approximately one hour. The order of the recording sessions was counterbalanced across patients. Two surface electrodes were placed over the sternocleidomastoid muscle near the surgical scar, to detect the activity of the VNS stimulator. In the STIM-ON condition, trials (duration: 30 sec) were initiated when the stimulator cycled off as evidenced in the neck recordings or in the EEG tracing. For patients whose off-cycle duration was less than 48 sec, the off-cycle duration was extended to allow for VEP recording. A total of 5 minutes (6 trials) of responses to each stimulus were collected for STIM-ON and STIM-OFF. Each 30 sec trial was divided into 10 sec epochs. We excluded all epochs in which there were artifacts or in which the device cycled on.

For controls we excluded, identical, except that only one set of 6 trials for each stimulus was collected, and no neck electrodes were placed.

ANALYSIS & RESULTS

- Raw VEP waveforms from each valid epoch were averaged and Fourier analyzed to obtain even and odd harmonic response components (above).
- Fourier components are represented as vectors, whose magnitude indicates amplitude and whose direction indicates phase (below).

There was no difference in VEP waveforms or waveform variability obtained during STIM-ON and STIM-Off sessions (above).

CONCLUSIONS

- Steady-state VEPs can be reliably recorded during VNS neurostimulation. Responses were not significantly different from responses obtained when the stimulator is turned off for an hour.
- Compared to normal controls, patients showed no difference in the facilitation index, but less lateral suppression (p<0.05 for gabapentin patients, p=0.07 for VNS patients).
- The similarity between the VEP measures obtained in the two patient groups is consistent with a similar mechanism of action of gabapentin and VNS on cortical lateral interactions.

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http://www-users.med.cornell.edu/~jdvicto/vps.html