Affects of Lyme disease on the Visual Processing System: Visual Evoked Potentials as a Biomarker for Diagnosis

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Abstract
Research is sparse on the affect of Lyme disease on Vision processing. Visual processing system is bi-modal; it maintains the balance between focal and ambient processes. Neurological events and/or injury can create an imbalance in the two visual processes. Lyme disease is an emerging vector-borne infectious disease which can cause compromise of the spatial visual processing causing affects of Post Trauma Vision Syndrome (PTVS) and ‘Focal Binding.’ We hypothesize that the Visual Evoked Potentials can be used to determine the affects of tick-borne disease on the visual processing system, this testing can be used as an early biomarker for diagnosis and treatment for Lyme disease.

Introduction

Most common symptoms reported by patients with tick-borne disease are fatigue, fever, headaches, blurred vision, pain and a characteristic erythema migrans rash. Lyme disease is difficult to diagnose and often mimics other pathologies. Frequently, there are early visual symptoms and characteristics that are caused by Lyme related disease.

Ocular complications have been previously reported, discussion about vision problems associated with Lyme disease are infrequent in the literature.

Visual Signs and Symptoms present in Tick-borne disease
- Blurred vision
- Diplopia
- Photophobia
- Eye strain
- Headaches
- Difficulty with near work
- Distortion of space
- Difficulty with balance
- Reduced depth perception
- Dizziness
- Conjunctivitis
- Vitritis
- Retinal vasculitis
- Optic nerve atrophy
- Bell’s Palsy
- Papilledema

Visual Problems

Visual processing system is bi-modal; it maintains the balance between focal and ambient processes. Focal visual process is detail oriented, used in conscious viewing, attention and concentration. Ambient visual process is dependent on spatial awareness; it’s a preconscious system that affects posture, balance and movement in space. The ambient system also establishes spatial orientation by utilizing the proprioceptive base of support.

Research shows that neurological events can create an imbalance in the two visual processes, causing subjects to rely heavily on focal processing system. This leads to symptoms of over-focalization, blurring of vision, difficulty reading, photophobia, spatial distortion and loss of balance.

Visual Evoked Potentials (VEPs) have been used to assist in the diagnosis of certain ocular pathologies by analyzing the amplitudes and latencies of the visual response. Any abnormality that affects the visual pathways or visual cortex in the brain can affect VEP output.

In our experimental control-matched study, we tested VEPs binocularly to detect the impact of Lyme disease on visual processing. We hypothesized that the N-75 would demonstrate increased negative amplitude due to ‘Focal Binding’ with Lyme subjects would detect significant variability in visual processing of Lyme patients compared to non-Lyme patients. And that prism can be used to affect visual processing to reduce ‘Focal Binding’ and thereby reducing the negative amplitude of the N-75 state of visual processing dysfunction.

Methodology

This study consisted of a control-matched experimental design to evaluate changes in VEP associated with active infection. The study tracked 20 subjects diagnosed with Lyme disease who tested positive on the Western blot test. 20 control subjects who had no previous history or symptoms did not associate with Lyme disease nor did they have symptoms or diagnosis of any known disease. N-75 amplitudes were recorded for both the experimental and control groups. Two dioptrase base in prisms were introduced before each eye for the experimental and control groups and the VEP was repeated.

Results

There is an overall reduction in the negative amplitude raw data with the introduction of prisms for the experimental group but not the control group. The tick-borne disease cohort had a lower N-75. The reduction in N-75 corresponds to the lack of readiness in the processing system to respond to visual stimuli and supports the theory of deficiency in the ambient process leading to focalization.

The results demonstrate that the negative amplitude of the N-75 is statistically significant as a biomarker for Lyme disease. Further, the addition of the base in prisms demonstrates a reduction in the N-75 for the experimental group but not the control group and was found to also be statistically significant.

Discussion

The negative amplitude of the N-75 serves as a biomarker demonstrating compromise of the spatial visual process in the case of Lyme disease. In addition, this research demonstrates that the compromise is a relative imbalance in bi-modal visual processing and that the use of base-in prisms are an effective means to restore balance in the bi-modal visual process.

Frequently visual symptoms are present in early stages of Lyme related disease. A thorough eye exam along with supportive testing can facilitate early diagnosis and treatment of Lyme disease. The VEP biomarker (N-75) and OCT-A provides a means for possible screening method for Lyme related disease. When symptoms are present of undiagnosed etiology together with the biomarker of the N-75 Lyme related disease should be ruled out.

References