A Randomised Controlled Trial Evaluating the Efficacy of NeuroVision’s Neurovisual Correction Technology in Enhancing Unaided Visual Acuity in Adults with Low Myopia

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Introduction

NeuroVision™ NVC vision correction technology is a non-invasive, patient-specific treatment based on visual stimulation and facilitation of neural connections responsible for visual function. The technology involves use of an internet-based computer generated visual training exercise regime using sets of patient specific stimuli based on Gabor patches, to sharpen contrast sensitivity and visual acuity. Previously, in a pilot non-comparative study1, it has been demonstrated by the same authors that NeuroVision’s Neural Vision Correction™ (NVC™) Technology has shown efficacy in enhancing unaided visual acuity in adults with low myopia.

The purpose of this study is to evaluate in a double masked randomized controlled trial the efficacy of NeuroVision’s Neural Vision Correction™ (NVC™) Technology in enhancing unaided visual acuity in adults with low myopia.

Scientific Background

Cortical neurons in the visual cortex function as highly specialized image analyzers or filters, responding only to specific parameters of a visual image, such as orientation and spatial frequency, and visual processing involves the integrated activity of many neurons, with inter- and intranetwork interactions both excitation and inhibition.2 Visual contrast activates neurons involved in vision processing, and neural interactions determine the sensitivity for visual contrast at each spatial frequency, and the combination of neural activities set Contrast Sensitivity Function (CSF)3,4. The relationship between neuronal responses and perception are mainly determined by the signal-to-noise ratio (S/N ratio) of neuronal activity, and the brain pools responses across many neurons to average out noise activity of single cells, thus improving S/N ratio, leading to improved visual performance and acuity5,6.

Studies have shown that the noise of individual neurons can be brought under experimental control by appropriate choice of stimulus conditions, and CSF can be increased dramatically through control of stimulus parameter.7 This precise control of stimulus conditions leading to increased neuronal efficiency is fundamental in initiating the neural modifications that are the basis for brain plasticity8,9,10. Brain plasticity (the ability to adapt to changed conditions in acquiring new skills) has been demonstrated in many basic tasks, with evidence pointing to physiological modifications in the adult cortex during repetitive performance11,12.

NeuroVision’s technology probes specific neuronal interactions, using a set of patient-specific stimuli that improve neuronal efficiency14-16 and induce improvement of CSF due to a reduction of noise and increase in signal strength. As visual perception quality depends both on the input received through the eye and the processing in the visual cortex, NeuroVision’s technology compensates for blurred (myopic) inputs, coming from the retina, by enhancing neural processing.

Technology Implementation

The fundamental stimulation-control technique is called “Lateral Masking”, where collinearly oriented flanking Gabors are displayed in addition to the target Gabor image. The patient is exposed to two short displays in succession, in a random order; the patient identifies which display contains the target Gabor image (Figure 2). Audio feedback is provided with an incorrect response. The task is repeated and a staircase is utilized until the patient reaches their visual threshold level.

The NeuroVision System

The NeuroVision System is a software-based, interactive system tailored and continuously adaptive to the individual visual abilities. In the first stage, the subject is exposed to a set of visual perception tasks, aimed to analyze and identify each subject’s neural inefficiencies or deficiencies. Based on this analysis, a treatment plan is initialized, and subject-specific efficacy is achieved by administering patient-specific stimuli in a controlled environment. Each session is designed to train, directly and selectively, those functions in the visual cortex, which were diagnosed to be further enhanced. At each session an algorithm analyzes the patient’s responses and accordingly adjusts the level of visual difficulty to the most effective for further improvement. Between sessions, the progress of the patient is taken into account by the algorithm for the next session generation. Thus, for each subject an individual training schedule is designed based on the initial state of visual performance, severity of dysfunction and progress in course of treatment. The treatment is applied in successive 30-minute sessions, administered 2-3 times a week, a total of approximately 30 sessions. Every 5 sessions, subject’s visual acuity is tested in order to continuously monitor subject’s progress. The average entire treatment duration is around 3 months.

Methods

• Adults aged 17-55, with Low Myopia, having cycloplegic spherical equivalent (SE) in the range of -0.50DS to -1.00DS and astigmatism in the range of 0.00DC to -0.75DC were included.
• A total of 124 patients were enrolled. Subjects were randomly divided into 2 groups: Group A (98 patients) and Group B (26 patients).
• The study was double masked.
• UAVA was tested at Baseline and at the End of Treatment using ETDRS charts.
• A significant improvement in UAVA was defined as improvement in UAVA of 0.2 logMar (2 lines) or more.
• Analysis was conducted only for those subjects who completed NeuroVision or sham treatment without any major incompatibility with the treatment schedule and protocol, and baseline Unaided Visual Acuity (UAVA) in both eyes was 0.2 logMar (30/20) or worse. This would include 67 patients in Group A and 17 patients in Group B.

Results

• See Table 1 for summary of baseline VA, end of treatment VA and improvement of VA.
• Mean Unaided Visual Acuity (UAVA) improved in Group A by 0.186 logMar vs. 0.023 logMar in Group B.
• See Table 2 for summary of statistical analysis
• Mean refractive error remained unchanged. No adverse events were reported.

Table 1. Summary of baseline VA, end of treatment VA, and improvement of VA

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Mean (SD)</th>
<th>Median (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>67</td>
<td>0.43 (0.15)</td>
<td>0.40 (0.20 – 0.80)</td>
</tr>
<tr>
<td>Group B</td>
<td>17</td>
<td>0.35 (0.10)</td>
<td>0.38 (0.20 – 0.50)</td>
</tr>
</tbody>
</table>

Conclusions

A higher percentage of the adults with low myopia in Group A demonstrated significant improvement in vision compared to those in Group B, and this is statistically significant. We have yet to unmask the two groups, as final follow up of both groups post-treatment is underway.

References