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*Intellectual & Developmental Disability Services*

## TMS in Clinical Trials as Treatment for Autism

The use of Transcranial Magnetic Stimulation (TMS) as a treatment for autism is undergoing clinical trials at the University of Louisville. The clinical trials started July 1, 2009; they build on a pilot study conducted by Manuel F. Casanova, M.D., and colleagues of the University of Louisville that found TMS stimulated areas of the brain producing cell-level changes that improved how the cells transmitted electrical signals to each other. The TMS-induced changes in the stimulated area created changes in other brain structures, leading to improved functioning in other areas of the brain that were not targeted by the treatment. Following TMS treatment, the study participants demonstrated better socialization skills, increased calmness, greater ability to follow instructions, and were better able to remain seated. Dr. Casanova's team of researchers now seeks to determine a therapeutic level of TMS, and to test the effectiveness of TMS treatment combined with other proven therapies for autism, such as applied behavior analysis.

TMS is a non-invasive, painless method of increasing electrical activity in specific areas of the brain. Office-based and portable TMS devices produce a strong magnetic field that can be targeted at specific areas of the brain by placing the device on the scalp. One aspect of the research is funded by a four-year \$900,000 grant from the National Institutes of Health (NIH), in the form of an NIH Exceptional, Unconventional Research Enabling Knowledge Acceleration grant recognizing the unique proposition and promising results of Dr. Casanova's pilot study with TMS as a treatment for people with autism.

The pilot study included 13 patients who received two TMS treatments per week for five weeks. The goal of the study was to determine if TMS could stimulate changes in the attributes of specific brain structures—minicolumns—which are part of the brain's cell-to-cell signaling systems that enable people to recognize faces and exercise judgment when confronted with multiple stimuli. Dr. Casanova had discovered during neuropathology research that the brains of people diagnosed with autism had abnormal minicolumns. He theorized that the abnormalities in the minicolumns affected all brain systems, leading to symptoms characteristic to autism spectrum disorders. This theory—that the brain is circuitry-based, composed of modules of cells that interact to form systems—is radically different from the more prevalent cell or structure-based view of the brain.

To test the theory, the researchers have conducted several studies; the results of two have been published in peer-reviewed journals—*Applied Psychophysiology and Biofeedback* and the *Journal of Autism and Developmental Disorders*. For these studies, the researchers recorded the participants' brain waves before and after the course of TMS treatment and then compared the wave patterns. The comparison indicated that TMS did stimulate and strengthen the minicolumns. The nature of the research was not focused on behavioral outcomes for the participants diagnosed with autism, although improvements in functioning were noted and described.

The full text of “Low-Frequency Repetitive Transcranial Magnetic Stimulation (rTMS) Affects Event-Related Potential Measures of Novelty Processing in Autism” was published on-line November 26, 2009 by *Applied Psychophysiology and Biofeedback*. The researchers were Estate Sokhadze, Joshua

Baruth, Allan Tasman, Mehreen Mansoor, Rajesh Ramaswamy, Lonnie Sears, Grace Mathai, Ayman El-Baz, and Manuel F. Casanova. An abstract may be accessed on-line at [www.springerlink.com/content/p381275868x32126/](http://www.springerlink.com/content/p381275868x32126/) (accessed March 25, 2010).

The full text of “Effects of Low Frequency Repetitive Transcranial Magnetic Stimulation (rTMS) on Gamma Frequency Oscillations and Event-Related Potentials During Processing of Illusory Figures in Autism” was published April 2009 by *Journal of Autism and Developmental Disorders*. The researchers were Estate M. Sokhadze, Ayman El-Baz, Joshua Baruth, Grace Mathai, Lonnie Sears, and Manuel F. Casanov. An abstract may be accessed on-line at [www.springerlink.com/content/4344302k14653132/](http://www.springerlink.com/content/4344302k14653132/) (accessed March 25, 2010).

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