

Improving Neuroimaging
for Autistic Individuals

This article is a review of the following research: Kuschner, E. S., Kim, M., Bloy, L., Dipiero, M., Edgar, J. C., & Roberts, T. (2021). MEG-PLAN: a clinical and technical protocol for obtaining magnetoencephalography data in minimally verbal or nonverbal children who have autism spectrum disorder. *Journal of Neurodevelopmental Disorders,* 13(1), 8.

Researchers around the world dedicate their careers to increasing our knowledge about autism. In some cases, researchers use neuroimaging to better understand how the brain of an autistic individual differs from that of a non-autistic individual. The most common neuroimaging technologies available for such research are Magnetic Resonance Imaging (MRI) and electroencephalogram (EEG). While an MRI is excellent for exploring and understanding brain structure, it requires a patient to remain entirely still for an extended period of time, is conducted in a small enclosed space, and the technology is quite loud when in operation. An EEG measures overall brain activity and is less overwhelming. It only requires that small electrodes be attached to the scalp. However, it has limited resolution and accuracy when compared to an MRI.

Given the MRI's testing requirements, many autistic individuals have been excluded from neuroimaging research, particularly those with intellectual disabilities and limited language abilities. It is assumed that these individuals would not be able to lie still for the MRI scan, and may have difficulty tolerating the sensory experience.[1]

Autistic individuals with intellectual disabilities and who are minimally verbal or non-verbal currently represent up to 40 percent of the autistic population.[2] To exclude this group from neuroscience findings would severely limit our understanding of brain function in a significant proportion of autistic individuals.

There is a need for neuroimaging that will support all autistic individuals. Dr. Emily Kushner from the University of Pennsylvania developed a protocol that makes neuroimaging more inclusive for autistic people, including those who are minimally verbal or non-verbal, or who have intellectual disabilities. Dr. Kushner's protocol uses a type of neuroimaging known as magnetoencephalography (MEG).

What is MEG?

MEG measures the electrical activity of the brain, including the location of the activity.[3] When many neurons in the brain are excited together, they generate a magnetic field that can be measured using a specialized helmet or probes. MEG has been used to measure how the brain responds to sound, face processing, social cognition, motor function and other aspects of brain function.[4]

This technology does not make any noise during measurement, and a patient can sit up or lie down during the scan. Measurements can also be made even if there is some minimal movement. The technology simply requires that a few sensors be placed on the face and head. Although this can still be uncomfortable for many autistic participants, it significantly increases the proportion of those who will be able to receive neuroimaging. Unlike an MRI, which measures brain activity by focusing on the blood flow near active neurons, an MEG directly measures neuronal electrical activity.

The goal of Dr. Kushner's study was to develop, implement and test a protocol for using MEG on autistic participants in hopes of including all autistic individuals in future neuroimaging research.

Study

The team of researchers developed a clinical and technical protocol known as the MEG Protocol for Low-language/cognitive Ability Neuroimaging, or MEG-PLAN. The study investigated the following: the approximate **scan time** and visit length for each participant; the **scan success** rate of the MEG-PLAN; and the **data quality** and reliability of the MEG-PLAN.

The study looked at 39 autistic children with ASD who ranged in age from eight to 12 years old. Each participant met the study definition of having limited language abilities. An interdisciplinary team was used throughout the process and included a behavior specialist, a MEG technologist, a neuroimaging research assistant and caregivers.

MEG-PLAN

In implementing MEG-PLAN, the researchers used the following steps.

Intake Interview

Intake Interview
Caregivers completed an intake interview and provided information on their child's challenging behaviors, preferred reinforcers, focused interests, triggers and behavior strategies.

Systematic Desensitization and Habituation

Systematic Desensitization and Habituation
The participants were gradually exposed to each step of the MEG process. Verbal and visual instructions were given, and parents were included in each step. If needed, additional information was provided to parents to enable further practice at home.

Differential Reinforcement

Differential Reinforcement
Participants practiced procedures in the protocol. For example, they practiced sitting in the MEG chair and wearing the sensors. Preferred reinforcements were given to encourage ongoing participation.

Visual Supports

Visual Supports
Video demonstrations, storybooks, and "first-then" boards were used to help children understand the MEG-PLAN process and follow instructions.

Individual Tailoring

Individual Tailoring
The MEG PLAN was tailored to each participant based on that individual's strengths, interests and needs.

Technical Components

Technical Components
The participants were not asked to make an active response during the neuroimaging. In addition, they were able to watch a video during the testing.

Results

- The average **scan time** was 45 minutes, with preparation time ranging from 10 to 30 minutes.
- Using the MEG-PLAN, 74 percent of participants were able to have a **successful MEG scan**.
- **Reliable measurements** were obtained even in those participants who moved a lot or made noise during the scan.

Conclusion

A new neuroimaging technique is needed in the field of autism research. With about 40 percent of the autistic population being excluded from MRI scans for a variety of reasons, our understanding of the autistic brain is incomplete. This research has shown that MEG, and specifically the MEG-PLAN process, is a feasible protocol for many autistic individuals with low cognitive or language abilities.

It is worth noting that many professionals and researchers often recommend that an MEG and EEG be performed at the same time in order to obtain a complete representation of brain activity.[5] The results of this early study show that MEG is a more inclusive and accommodating way to acquire neuroimaging in autism research. The use of MEG can ultimately lead to a more thorough understanding of autism across the entire spectrum.

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