NEUROIMAGING TECHNIQUES FOR LISTENING TO THE BRAIN

(image) **Peter J. Savino, M.D.**

It is amazing that 40% of the nerve fibers in the human brain help carry visual information. As a result, damage to the brain often causes loss of peripheral vision in both eyes to the side opposite the brain lesion. These visual defects are known as homonymous visual field defects, and are almost always detectable on MRI (magnetic resonance imaging) scanning.

Peter J. Savino, M.D., Clinical Professor of Ophthalmology and Neurosciences at the Shiley Eye Center, examined a 34-year-old professional boxer with blurred vision and bilateral homonymous visual field loss. The patient, who had previously been examined elsewhere, had "checkerboard" visual field abnormalities. Such abnormalities are typically caused by bilateral occipital lobe (the back region of the brain) lesions. However, three MRI scans were normal and therefore, the patient was diagnosed as "pretending" to have the defect by the other doctors. Dr. Savino considered the boxer's defects to be real, but in order to be sure he needed to demonstrate that damage to the specific areas of the brain could produce the visual loss.

One of the two techniques Dr. Savino employed was magnetoencephalography (MEG), a precise, noninvasive technology of measuring brain activity through the detection of the tiny magnetic fluctuations (bio-magnetism). MEG, unlike MRI, functional MRI, PET or SPECT scanning measure brain metabolism, measures the magnetic field associated with a moving electrical impulse. The spatial distributions of the magnetic fields are analyzed to localize the sources of the activity within the brain and the locations of the sources are superimposed on an anatomical brain map. Events with time scales on the order of milliseconds can be resolved and can be localized to within a millimeter.

The patient's MEG revealed alteration of the electrical signal on each side of the brain to account for his homonymous visual field defects, and thus established that the abnormalities were real and that the patient was not faking the symptoms. Moreover, they were confirmed with another test, diffusion tensor imaging (DTI) that measures the diffusion of water in brain tissue. The pattern of the abnormalities on DTI likewise were in the areas of the MEG abnormalities. With these results, Dr. Savino then advised the patient that the defects would not worsen but not improve, and he was counseled to retire from boxing.

Dr. Savino is an original member of the Optic Neuritis Treatment Trial and has published extensively on optic neuritis and other disorders of the optic nerve. He wrote two important textbooks on Neuro-ophthalmology that are utilized worldwide by ophthalmologists and he has been recognized with prestigious awards including the Heed Foundation Award and the Lifetime Achievement Award from the American Academy of Ophthalmology. Dr. Savino also is a dedicated teacher. He has been voted Best Teacher of the Year by Ophthalmology residents in four different decades.

(image)
Whole-head Magnetoencephalography (MEG) System