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The Use of Brain Imaging in Clinical Practice: Two Case Studies

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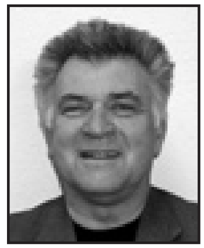

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Most people would be appalled if a cardiac specialist made a diagnosis of heart trouble and prescribed medication without first performing an EKG and running other cardiac tests. Yet the equivalent is occurring every day in the treatment of psychiatric disorders. While the technology exists in 2009 to observe the functioning of many organs of the body, anecdotal evidence suggests the only organ for which medication is routinely prescribed without a direct, objective assessment is--the brain. This article describes how a brain imaging technology is being used in one clinical psychology practice to attempt to make more accurate diagnoses and evaluate the impact of treatment.

Electroencephalogram Spectral Analysis

A number of technologies have emerged in recent years for examining brain functioning, including magnetic resonance imaging, computed tomography, and diffusion tensor imaging. (See Douglas & Bremmer, (2005) for a detailed description of these technologies.) The device used to evaluate brain functioning in the two case studies described in this article is the Digital Electroencephalogram Spectral Analysis (DESA®), a neuroelectrical evaluation system developed at Harvard's Boston Children's Hospital. The DESA® at its core is an EEG, bundled with five other measurement techniques, including auditory evoked responses/potentials (AER), frequency modulated auditory evoked responses (FMAER) and P300. The AER assesses functional pathways as sound travels and is processed from the ear to the temporal cortex of the brain. The FMAER employs a specific auditory wavelength that "warbles" in pitch, creating a sound the brain recognizes as language. The P300 identifies the parameters of attention in different parts of the brain. Brain wave measurements are compared to a normative database of 15,000 patients and converted into a series of color images of the brain. A complete description of the DESA® can be found at: http://www.yellenandassociates.com/what-desa.php.

What follows are two case studies illustrating how the DESA® has been employed in our clinical practice.

Robert

Robert (not his real name) was in his early 20s, had recently been discharged from a rehabilitation facility, and was due to be shipped to an out-of-state halfway house when he was referred to me. He had a history of substance abuse and had been diagnosed with attention deficit disorder by the medical staff, who informed me he was "oppositional-defiant" during his stay. They noted that he had a difficult time during group therapy, often walking out of the room in mid-session. Robert was taking a number of psychotropic medications prior to his stay in rehab, including Adderall (a central nervous system stimulant) for attention deficit disorder, Zoloft for depression and anxiety, and Risperdal for bizarre ideation.

Based on the report from rehab, I expected Robert to be a difficult, even belligerent client. Instead, he presented as calm, pleasant, polite, and smiling. During our initial session I noted that all his verbal responses were delayed. I asked him why he walked out of group. "With everyone talking at me, I felt like I was under attack and I had to escape," he said.

We performed a thorough psychological assessment of Robert, which included a DESA®. The results of the DESA® confirmed several of our suspicions about his functioning. First, despite his pleasant and calm demeanor, Robert was experiencing high levels of anxiety. Anxiety appears in DESA® brain imaging as bright colors in the temporal lobes, indicating high levels of beta activity or hyper-alertness. Robert's brain images looked like two light bulbs on either side of his head.

Second, we found that Robert's auditory evoked response was slow. Examining the successive images, it was clear that Robert's entire auditory processing mechanism was incredibly slow. Most individuals recognize sound between 80-100 milliseconds, fully process the sound by about 150-180 millisec-

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onds, and then the brain clears waiting for the next stimulus. Robert's brain took almost 200 milliseconds to recognize the sound (3+ STD below the norm) and continued to process the sound for close to 500 milliseconds (4+ STD above the norm). In addition, his brain's recognition of sound as language was intermittent at best. Robert did not have an attention deficit disorder, but a deficit of attention secondary to slow auditory processing and a high level of anxiety. These results helped explain Robert's behavior in group: He was walking out, in part, because he could not keep up with or process the flood of auditory input from group participants. He fled group to escape the barrage. Interestingly, the DESA® also revealed that he had very strong visual processing abilities.

Based on what we learned from the DESA®, we modified our therapy by slowing down the pace of our speech by about half. We also used a lot of imagery as we worked through his issues. Subsequent to his therapy we helped direct him into a very satisfying career in film editing, where he was able to take advantage of his visual processing skills.

William

The second case involved William (again, not his real name), a male in his early 30s who was diagnosed with AD/HD as a child. He took Ritalin for his attention deficit for some years and then was switched to Adderall. William attended special education classes in school but continued to have problems in school and eventually dropped out of high school. He wandered from job to job and got into trouble with the law.

We were asked to perform an assessment of William, which included a DESA®. His receptive speech appeared delayed, and he needed clarification on much of the conversations in which he participated. His expressive speech was very dysfluent as he struggled with his words. He had an inconsistent FMAER, which can be likened to bad cell phone reception, i.e., his recognition of speech-like auditory stimuli faded in and out, forcing him to try and fill the gaps in his comprehension. His normal P300 profile indicated that he could recognize the phonemes that did manage to get through. The DESA® also revealed that William's central auditory processing area exhibited an inordinate amount of theta wave activity--theta waves being associated with "drowsiness." His slow processing translated into a problem with memory; on some memory subtests William scored in the 1st percentile.

To sum up, the central nervous system stimulants William was taking had the effect of creating a logjam of incoming information while not adequately addressing his slow central auditory processing issues. Robert was taken off his other medications and switched to Provigil (modanfanil), a medication that is FDA approved for treating narcolepsy. William's subsequent performance dramatically improved. He displayed speech fluidity, improved memory and recall, and a greater ability to engage in logical patterns of discussion. The improvement in performance was confirmed by the images obtained in a follow-up DESA®.

Conclusion

As psychologists, it is imperative before designing treatment plans that we understand the neurofunctioning of our patients. In our view, an objective evaluation of the brain's electrical activity compliments and validates a good standard assessment regimen, laying the groundwork for effective and efficient psychotherapeutic intervention. ▲

References

Douglas, J., & Bremmer, M.D. (2005) *Brain Imaging Handbook*. New York: W. W. Norton & Co.

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