

Functional neuroanatomy and the rationale for using EEG biofeedback for clients with Asperger's syndrome. - Thompson L - *Appl Psychophysiol Biofeedback* - 01-MAR-2010; 35(1): 39-61 (MEDLINE® is the source for the citation and abstract of this record)

Abstract:

This paper reviews the symptoms of Asperger's Syndrome (AS), a disorder along the autism continuum, and highlights research findings with an emphasis on brain differences. Existing theories concerning AS are described, including theory of mind (Hill and Frith in *Phil Trans Royal Soc Lond, Bull* 358:281-289, 2003), mirror neuron system (Ramachandran and Oberman in *Sci Am* 295(5):62-69, 2006), and Porges' (*Ann N Y Acad Sci* 1008:31-47, 2003, *The neurobiology of autism*, Johns Hopkins University Press, Baltimore, 2004) polyvagal theory. (A second paper, *Outcomes using EEG Biofeedback Training in Clients with Asperger's Syndrome*, summarizes clinical outcomes obtained with more than 150 clients.) Patterns seen with QEEG assessment are then presented. Single channel assessment at the vertex (CZ) reveals patterns similar to those found in Attention-Deficit/Hyperactivity Disorder. Using 19-channel data, significant differences (z -scores > 2) were found in the amplitude of both slow waves (excess theta and/or alpha) and fast waves (beta) at various locations. Differences from the norm were most often found in mirror neuron areas (frontal, temporal and temporal-parietal). There were also differences in coherence patterns, as compared to a normative database (Neuroguide). Low Resolution Electromagnetic Tomography Analysis (Pascual-Marqui et al. in *Methods Find Exp Clin Pharmacol* 24C:91-95, 2002) suggested the source of the abnormal activity was most often the anterior cingulate. Other areas involved included the amygdala, uncus, insula, hippocampal gyrus, parahippocampal gyrus, fusiform gyrus, and the orbito-frontal and/or ventromedial areas of the prefrontal cortex. Correspondence between symptoms and the functions of the areas found to have abnormalities is evident and those observations are used to develop a rationale for using EEG biofeedback, called neurofeedback (NFB), intervention. NFB training is targeted to improve symptoms that include difficulty reading and mirroring emotions, poor attention to the outside world, poor self-regulation skills, and anxiety. Porges' polyvagal theory is used to emphasize the need to integrate NFB with biofeedback (BFB), particularly heart rate variability training. We term this emerging understanding the Systems Theory of Neural Synergy. The name underscores the fact that NFB and BFB influence dynamic circuits and emphasizes that, no matter where we enter the nervous system with an intervention, it will seek its own new balance and equilibrium.

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