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Neurofeedback with Cerebral Palsy and Mental Retardation: A Case Report

Alan Bachers PhD ^a

^a Neurofeedback Foundation , 34 So Main Street, Chagrin Falls, ON, 44022

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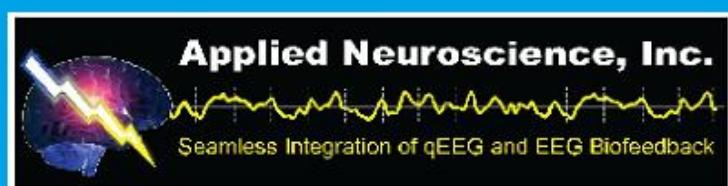
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Neurofeedback with Cerebral Palsy and Mental Retardation: A Case Report

Alan Bachers, PhD

This is a case report of a long-term neurofeedback training experience with a boy who is now 13-years-old and has cerebral palsy. He was brought in for neurofeedback by his mother at age eight. A CAT scan showed the cranial vault was filled in the central to posterior third with inert matter, the remains of an intracranial hemorrhage, resulting from a vacuum extraction following a protracted labor. A shunt was needed to moderate hydrocephalic pressure. On the CAT scan, various brain regions could be discerned splayed around this core, likely rendering the usual International 10-20 landmarks irrelevant with regard to actual brain sites. His muscles were largely flaccid with a severe contracture of the left arm. He could hold his head up, grasp and use large markers and utensils, and feed himself with his right hand. To this day he has no bladder or bowel control.

He was raised by intelligent, attentive, but divorced parents and grandparents who sought to maximize the quality of his life. A verbal IQ score of 48 was attained on the Wechsler Intelligence Scale for Children III (WISC-III) in a November 1998 testing. Despite this, he was alert, able to converse coherently, recalled my name in the first session and showed limited affective responses nearly appropriate to his age. He had been raised in relative isolation due to extreme startle responses which, once initiated, resulted in up to hours of flailing, moaning and being out of control. This was only somewhat moderated by medication. These reflexive responses were, unfortunately, triggered by laughter or clapping on the radio or TV, loud noises in a restaurant or church, and any unexpected noise. He would also become agitated if the routine of his daily activities became disrupted with regard to sleeping, eating, or

Alan Bachers is affiliated with Neurofeedback Foundation, 34 So Main Street, Chagrin Falls, ON 44022.

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anticipated activities. We started neurofeedback in July 1998 on a Neurocybernetics system with 20 minutes of training at C4, rewarding 12-14 Hz and inhibiting both 4-7 Hz and 23-30 Hz, with the 23-30 Hz largely removed from inhibition due to muscular dyscontrol. My inadvertent laughter at the end of the session precipitated an episode of seemingly involuntary flailing, guttural grunts, moaning and crying that lasted for several minutes. His mother felt that the episode was unusually brief, reporting that they often lasted for over an hour. From that first session he was able to decrease the intensity and duration of the startle responses to the point that in the summer of 2001 he attended a rock concert given in his honor to raise money for a wheelchair lift van.

The course of neurofeedback has been comprised of generally biweekly sessions totaling over 200 in number. Session baseline readings showed generally high amplitude, low frequency activity wherever we would look with a monopolar or bipolar electrode placements. Initial work focused on down-regulating neuromuscular over-arousal at C4 and along the sensorimotor strip. Following the sixth session, in which we expanded the feedback to C4-T4, rewarding 12-15 Hz, reduction of claudication of the left arm was sufficient for him to pick up, move and put down small objects-a first for him. Overall, in the 4-7 Hz range, amplitudes averaged mid-20s to mid-30s in microvolts at baselines. Reductions in the theta band were accomplished in most sessions when training 12-15 Hz as the reward frequency, infrequently going below 20 μ V. As this training with 12-15 Hz rewards established gains of emotional and behavioral calming, he became more cognitively alert and able to progress in his home schooling, especially in the auditory-verbal realms. Cautious initiation of left-sided 15-18 Hz reward, first at C3 then C3-Fp1 brought only rare agitation and further gains in time awareness, sequencing operations, and arithmetic functions. Stages of cognitive and emotional maturation have unfolded in appropriate and satisfying ways.

Approximately the last 50 sessions have been on a NeuroCarePro system with bilateral C3 and C4 placements. We start these sessions with a "squash all" protocol, inhibiting 1-42 Hz in an effort to decrease spasticity. Then we add up to 16 frequency groupings (on his best days). Constant adjustment of the reward criteria early in this part of the session often brings him to a very smooth and settled CNS state that he can maintain for varying lengths of time. Effects of lowered neuromuscular over arousal, intellectual and emotional balance, and sense of well-being persist from days to weeks following a "good" session. His mother has recently purchased and been trained in the use of a BrainMaster neurofeedback unit that has been added to his regimen.

The verbal portion of the WISC-III was repeated in December 2002 and showed a score of 72, a 24 Verbal IQ point increase from the 1998 testing.