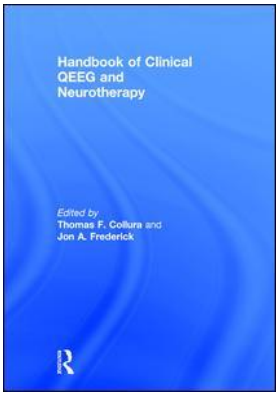

Handbook of Clinical QEEG and Neurotherapy

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QEEG-Guided Neurofeedback to Normalize Brain Function in Various Disorders

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PART III

The Neurologist's Perspective

9

QEEG-GUIDED NEUROFEEDBACK TO NORMALIZE BRAIN FUNCTION IN VARIOUS DISORDERS

Jonathan E. Walker

Abstract

QEEG-guided neurofeedback for various disorders is reviewed. In the first section, specific disorders treated in our clinic are reviewed (anger control disorder, dysgraphia, dyslexia, and enuresis). The second part is a literature review of the other successfully treated disorders using QEEG-guided neurofeedback with a bibliography of published articles.

Introduction

In our clinic, we have had success in QEEG-guided neurofeedback in several disorders using specific abnormalities in the QEEG to guide the training. Patients with a given disorder are evaluated with a QEEG. QEEG abnormalities which are present in the subjects are then trained with neurofeedback to decrease abnormally elevated values or increase abnormally decreased values. This is usually accomplished in five to ten sessions per abnormality. The database we have used is the Thatcher Neuroguide, eyes open, for all disorders. Pre and post scores were obtained if a scale existed. If resolution of the problem occurred, that was noted and the results for the group were then determined.

I. Specific Disorders Trained in Our Clinic

A. Anger and Anger Control Disorders[1]

The QEEG correlates for anger were excessive 21–30 Hz activity at one or more cortical areas. The QEEG correlates for anger control were excessive 1–10 Hz at central sites (C4, Cz). When these abnormalities were normalized, anger was decreased, and anger control was increased.

B. Dysgraphia (in Right-Handed Individuals)[2]

The QEEG correlate was excessive 1–10 Hz at C3. Remediation was accomplished by normalizing 1–10 Hz at C3.

C. Dyslexia[3]

QEEG correlates included one or more of the following:

1. Excess 1–10 Hz at FZ and/or F1, producing attention difficulty.
2. Excess 1–10 Hz at O1 and/or O2, producing visual processing difficulty.
3. Excess 1–10 Hz at T5 and/or T6, producing auditory processing difficulty.
4. Excess 1–10 Hz at T3 and/or T4, producing short-term memory difficulty.
5. Excess 1–10 Hz at F1, producing expressive language difficulty.
6. One or more decreases in coherence (i.e., disconnection) patterns between the areas noted above.

Remediation was accomplished by downtraining of excessive 1–10 Hz in areas where it was increased and by increasing coherence where it was decreased.

D. Enuresis[4]

No specific QEEG abnormalities. Single band magnitude topography revealed 1–3 microvolts at Oz (not a QEEG site), vs. 0–1 microvolts at Oz in persons with good bladder control.

Remediation of anxiety was obtained with 5–10 sessions to decrease 1–7 Hz and increase 15–18 Hz at Oz in 18 of 20 cases. Two cases that failed with that protocol were later remediated by five sessions of C4 training to decrease 2–7 Hz and increase 12–15 Hz (unpublished).

E. Epilepsy (Drug Resistant)[5, 6, 7]

QEEG correlated with excessive 1–10 Hz in multiple areas, with or without decreases in coherence of delta and theta in one or more coherence pairs.

Neurofeedback remediation was carried out by normalizing 1–10 Hz in areas where it was increased and normalizing coherence in affected pairs.

F. Migraines[8]

QEEG correlates were excessive 21–30 Hz in 1–4 cortical areas (most commonly P3 and/or P4)

Neurofeedback remediation was carried out by normalizing 21–30 Hz in the affected areas.

G. Post-Traumatic Stress Disorder[9]

QEEG correlates were excessive 21–30 Hz and reduced alpha power at parietal sites (P3 and P4). Remediation was accomplished by decreasing 21–30 Hz and increasing 10 Hz at P3 and P4.

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II. Literature Review

Table 9.1 Published series by other investigators of cases successfully treated with QEEG-guided neurofeedback for various disorders.

Condition	*Characteristic QEEG Abnormalities*	*Effective Neurofeedback Protocols*	*Key Ref*
ADD/ADHD	Excessive slow (1–10 Hz) or fast (11–30 Hz) activity at F1/F2/F3/F4 (absolute or relative)	Downtrain all excessive slow or fast activity at F1/F2/F3/F4	1
Abuse/Neglect	Depression correlated with increased relative power left frontal sites	Decrease excessive 1–10 Hz at frontal and central sites	2
Age-Related Cognitive Decline	Increased theta power and decreased mean frequency, in several areas	Decrease excessive 1–10 Hz in all abnormal areas	3, 4
Alcoholism	Excessive 21–30 Hz at F3 and F4 correlates with craving, anxiety, and irritability	Decrease excessive 21–30 Hz at F3 and F4	5, 6
Anorexia/Bulimia	Increased 8–10 Hz in central, parietal, and limbic areas. Alpha 1 was increased in bulimia	Decrease excessive alpha and excessive 21–30 Hz in central areas	7, 8
Allergies	Decreased beta 1 power in temporal and right frontal regions	Increase beta 1 power in temporal and right frontal areas	9
Amblyopia	Excessive 1–10 Hz at O1 and/or O2	Decrease 1–10 Hz and increase 15–18 Hz at O1 and O2 (5–10 sessions)	10
Amphetamine Dependence, Addiction	Increased delta and theta power in frontal and central regions	Decrease elevated delta and theta in affected areas and increase 12–15 Hz in those areas (5–10 sessions, each area)	6
Cerebral Palsy/Spastic Diplegia	Increased delta and theta in most leads, reduced alpha O1/O2, and decreased interhemispheric coherence of alpha and theta	Decrease 21–30 Hz and increase 10 Hz in affected areas (especially C3/C4), and increase coherence in affected pairs	11
Hemiparesis	Asymmetries in all frequencies between hemispheres with increase of delta and theta interhemispheric	Normalize coherence between hemispheres	12, 13

(*Continued*)

Table 9.1 (Continued)

Condition	*Characteristic QEEG Abnormalities*	*Effective Neurofeedback Protocols*	*Key Ref*
Chronic Fatigue Syndrome	Excessive high-frequency beta at C3/Cz/C4	Decrease 21–30 Hz and increase 10 Hz at C3/Cz/C4	14, 15
Closed Head Injury	Increased power at 1–10 Hz and decreased power in low delta frequencies (11–20 Hz) at several sites, especially frontal and temporal	Decrease power in slow frequencies (1–10 Hz) and increase power in beta frequencies (15–20 Hz) in affected areas	16, 17
Cocaine Addiction	Decreased absolute and relative power of delta and increased relative power of alpha	Decrease relative power of alpha in affected areas	6, 18, 19, 20
Coma (Level 2) (25/32 Patients Regained Consciousness)	Poor outcome after trauma correlated with reduced left hemispheric beta power in frontal, parietal, and centrotemporal regions and reduced alpha power in the centrotemporal regions	Bipolar training (T3/C3 and T4/C4) to decrease 2–7 Hz and increase 15–18 Hz (5 sessions each pair of sites)	21, 22
Complex Regional Pain Syndrome	Delta and/or theta activity localized to the somatosensory cortex and the orbital frontal cortex	Decrease 2–7 Hz and 22–30 Hz at C3 for right-sided pain decrease, at C4 for left-sided pain decrease	23, 24
Conduct Disorder (Juvenile Offenders)	Excessive frontal/central 1–10 Hz activity	Wide-band amplitude reduction (2–30) at F3 and F4 followed by wide-band reduction (2–30 Hz) at C3 and C4, followed by theta (2–7 Hz) and right beta (20–26 Hz) reduction and SMR (11–15 Hz) enhancement (20 sessions)	25
Dissociative Identity and Host Disorder	Decreased coherence in alter personalities with excessive frontal alpha activity	Decrease excessive 1–10 Hz in the frontal areas (plus cognitive behavioral therapy)	27, 28
Down's Syndrome	Excessive 1–10 Hz in several brain areas	Decrease 1–10 Hz and increase 15–18 Hz in affected areas	29, 30
Dyscalculia	Excessive 1–10 Hz at F7 and F3 (calculations). Excessive 1–10 Hz at P4 (word problems)	Decrease excessive 1–10 Hz in affected areas	39
Fetal Alcohol Syndrome	Excessive frontocentral, parietal, and posterior temporal 1–10 Hz activity	Decrease excessive 1–10 Hz in all affected areas	31, 32
Fibromyalgia	Excessive 1–10 Hz in frontal areas, with increased 21–30 Hz in frontal and central areas, widespread coherence decreases in low to medium frequencies frontally	Decrease 1–10 Hz and 21–30 Hz in the affected areas	33, 34
Hallucinations (Auditory)	Increased beta-1, beta-2, and gamma power in left inferior parietal lobe and left medial frontal area	Decrease excessive beta and high-frequency beta in the affected areas	35, 36
Hyperactivity/ Impulsivity	Excessive 2–7 Hz and/or 21–30 Hz at F4 and/or C4	Decrease 2–7 Hz and 20–30 Hz at F4 and C4	37, 38

Condition	*Characteristic QEEG Abnormalities*	*Effective Neurofeedback Protocols*	*Key Ref*
Marijuana Addiction, Chronic	Increased absolute and relative power of alpha ("hyper-frontality") and decreased relative power of delta and theta	Decrease 8–12 Hz and increase 15–18 Hz at C3 and C4 (5–10 sessions)	40, 41
Mental Retardation	Increased theta, alpha, and coherence abnormalities	Decrease excess theta, alpha, and coherence abnormalities in all areas (80–160 sessions)	42
Mild Cognitive Impairment	Excessive absolute power of theta	Decrease 2–7 Hz and increase 15–16 Hz at the affected areas	43
Obsessive Compulsive Disorder	Decreased alpha and beta power and increased theta power in frontotemporal regions with increased 21–30 Hz at C3 and C4	Decrease 21–30 Hz, 2–7 Hz, and increase 10 Hz at C3 and C4 (5–10 sessions)	44
Opiate Addiction	Excessive frontal slowing (2–7 Hz) and increased high-frequency beta (21–30 Hz)	Decrease 2–7 and 21–30 Hz, and increase 10 Hz in the affected areas (5–10 sessions each)	6
Pain, Neurogenic	Excessive power at 7–9 Hz maximal in the frontal regions	Decrease elevated 2–25 Hz in affected areas	45, 46
Parkinsonism	Excess frontal theta (4–6 Hz), beta (12–18 Hz), and gamma (30–45 Hz)	Decrease frontocentral theta and beta, and decrease 21–30 Hz to decrease tremor, and decrease parietal 21–50 Hz to reduce akinesia and rigidity	47, 48
Panic Disorder/ Phobias	Increased frontal beta (13–26 Hz) with increased right frontal alpha and decreased left temporal theta power	Decrease excessive beta and/or alpha wherever it is found in the cortex	50
Periodic Leg Movements of Sleep/Restless Legs Syndrome	Excessive absolute power of alpha (9–12 Hz) centrally, and excessive beta power (13–30 Hz) along the midline (Cz/Pz)	LENS training (15 sessions) focused on 9–12 Hz and 7–12 Hz activity.	49
Premenstrual Syndrome/ Dysphoric Disorder	Increased delta, theta, and fast alpha (11–12 Hz) in the late luteal phase relative to the follicular phase	Decrease 4–7 Hz and 22–30 Hz where elevated, and increase 12–15 Hz at C4, 15–18 Hz at Cz	51, 52
Psychopathy/ Sociopathy	Excessive frontal alpha, theta, and beta power as well as alpha, theta, and beta coherence abnormalities	Normalize excessive alpha, theta, and beta power as well as coherence abnormalities (80–120 sessions)	53
Reactive Attachment Disorder	Excessive frontal and central excessive 20–32 Hz at FZ and Cz, and excessive 8–12 Hz in parietal and posterior temporal regions	Decrease excessive frontal and central 1–10 Hz (10–15 sessions), decrease excessive 20–32 Hz at FZ and Cz (5–10 sessions), and 8–12 Hz in parietal and posterior temporal regions	54–55
Restless Legs Syndrome	Absolute power excess in alpha (central) and beta (C7 and P7)	LENS training (3 patients) (20 sessions) focused on F7/Cz/C4/ Pz	56

(*Continued*)

Table 9.1 (Continued)

Condition	*Characteristic QEEG Abnormalities*	*Effective Neurofeedback Protocols*	*Key Ref*
Schizophrenia	Excessive frontal delta (1–3 Hz) and high-frequency beta (21–30 Hz), and increased 1–10 Hz in right parietal region	Decrease right parietal and left anterior temporal activity, frontal delta, and fast beta activity, reward 8–12 Hz and inhibit 2–7 Hz at FPO2 to treat depression, inhibit alpha, theta, and beta at F7/T3 (bipolar) for paranoia, 19/50 subjects responded, i.e., no longer schizophrenic. 27 subjects were able to discontinue their medication	57, 58
Spelling Difficulties	Excess slow activity (1–10 Hz) at T6	Decrease 1–10 Hz at T6 (5–20 sessions)	59
Stroke	Focal excess of 1–7 Hz in affected areas	Decrease 1–7 Hz and increase 15–21 Hz in affected areas (7–10 sessions each)	60, 61, 62, 63
Stuttering	Excess focal slowing (1–10 Hz) at F7 or F8. Reduced coherence between F7 and other areas	Decrease 1–10 Hz at F7/F8 and normalize coherence in abnormal pairs	64
Tic Disorder/ Tourette Syndrome	Reduced SMR plus excess theta at C3/C4	Decrease 1–10 Hz and 21–30 Hz and increase 12–15 Hz at C3/C4	65, 66
Tinnitus	Excess 21–30 Hz and 40–80 Hz with reduced alpha power in temporal regions (T3, T4, T5, T6) and frontal regions (F3/F4)	Decrease elevated 21–30 Hz and increase 10 Hz in affected temporal areas and frontal areas	67, 68
Vertigo	Increased relative theta in the centrotemporal region with peripheral vestibular dysfunction	Decrease elevated 2–8 Hz at FZ, decrease elevated 21–30 Hz at C3 and C4	69
Violence	Bilateral frontocentral slowing excess 2–10 Hz	Decrease 2–10 Hz and increase 12–15 Hz in frontocentral areas	72, 73

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