

QEEG in Autistic Disorders: Power and Connectivity Analyses

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Presented at ISNR, 2006
Atlanta, Georgia.

Previous EEG/QEEG Findings

- Cantor et al. (1986) – Maturational delay, including excess slow wave activity, greater coherence and less asymmetry.
- Ogawa et al. (1982) – Signs of diminished hemispheric lateralization, excessive bilateral frontal alpha activity.
- Dawson et al. (1982) – EEG signs of reversed lateralization in 30%.
- Hashimoto et al. (2001) – Spike discharges frequent in frontal regions.

Previous MRI/PET Findings

- McAlonan et al. (2005) – Reduction in total grey matter volume, increase in CSF volume, reduced connectivity in fronto-striatal and parietal networks.
- Chabane et al. (2002) – Hypoperfusion of bilateral temporal, superior temporal gyrus, superior temporal sulcus in 77%.
- Murphy et al. (2002) – Significant prefrontal hypometabolism on MRI Spectroscopy related to Aspergers symptom severity.

Connectivity Findings

- Chung et al. (2004) – Less white matter concentration in the genu, rostrum, splenium.
- Casanova et al. (2002) – Cell columns are more numerous, smaller and less compact in frontal and temporal regions.
- Just et al. (2004) – Diminished connectivity in language areas during sentence comprehension.
- Courchesne & Pierce (2005) – Frontal lobe hyperconnectivity and frontal to other hypoconnectivity.

Coben, Hudspeth, Clarke and Barry (2005)

- 20 Patients consecutively seen in a clinical practice (US) with diagnosis of Autistic Spectrum Disorder or Autism. Original sample of 30 was reduced based on age and medication usage.
- 20 person Control group matched for age, IQ and gender (Australia).
- There were no significant differences between the groups for age, IQ or gender.

	Autistics	Controls
Age in months	107	110
Mean FSIQ	93	98
Gender	14 Males 6 Females	14 Males 6 Females

Results: Absolute and Relative Power

- Autistics have less absolute and relative delta, maximal over the right posterior region.
- Autistics have greater relative theta, especially in the right posterior region.
- Autistics have lower absolute beta across the right hemisphere, especially over the right frontal region.

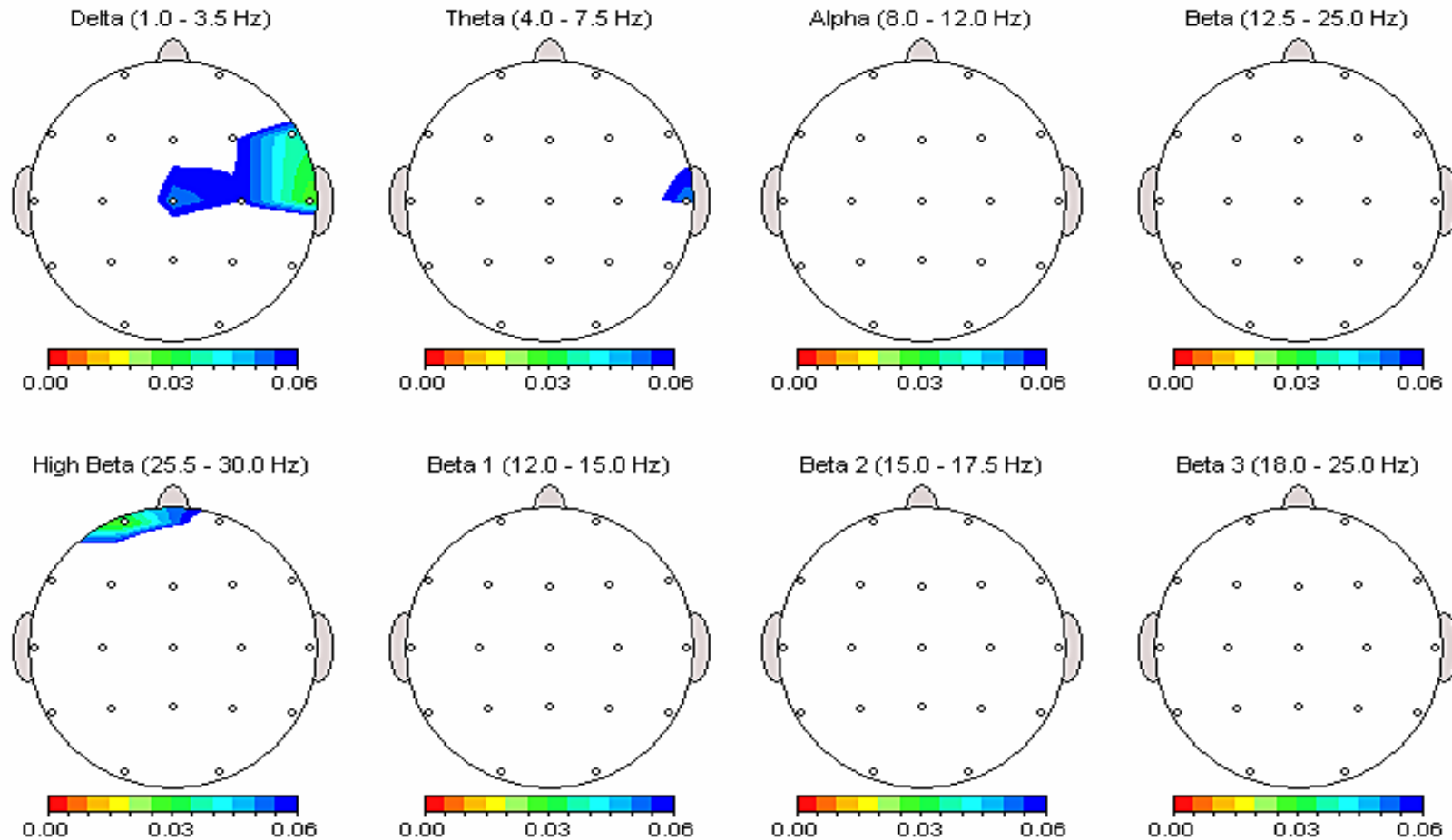
Results: HypoCoherence

	DELTA	THETA	ALPHA	BETA
<u>Intrahemispheric Coherences</u>				
<i>short-medium</i>				
L vs. R	---	---	---	---
Autistic vs. Controls	****	***	---	p = .071
Autistic vs. Controls X L vs. R	---	---	---	---
<i>long</i>				
L vs. R	---	---	---	---
Autistic vs. Controls	****	***	---	---
Autistic vs. Controls X L vs. R	---	---	---	---
<u>Interhemispheric Coherences</u>				
<i>frontal</i>				
Autistic vs. Controls	***	*	---	---
<i>temporal</i>				
Autistic vs. Controls	*	***	**	---
<i>central/parietal/occipital</i>				
Autistic vs. Controls	*	*	p = .064	*
* p<.05, ** p< .01, *** p< .005, **** p<.001				

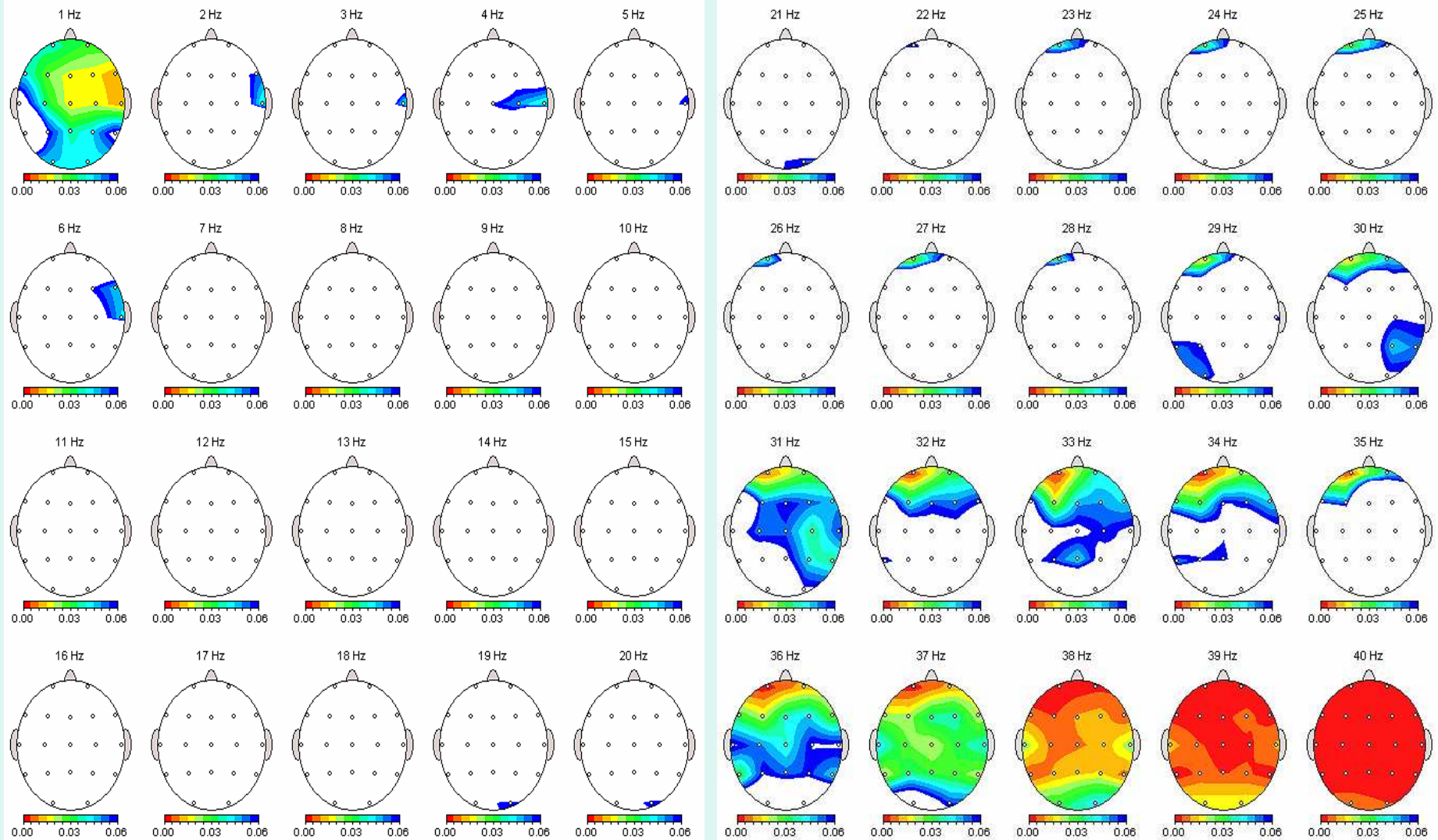
Methodology

- 27 Autistics and 27 “Normals” matched for age, race, gender, medication usage (none).
- Normals had mean IQ =103.2, mean age = 9 years, 8 months, screened for reading, spelling, behavior problems, head injury, ADHD, medication use, psychiatric diagnosis, learning problems.
- QEEG performed resting eyes closed.
- All EEG artifacting done by same person with over 30 years experience.

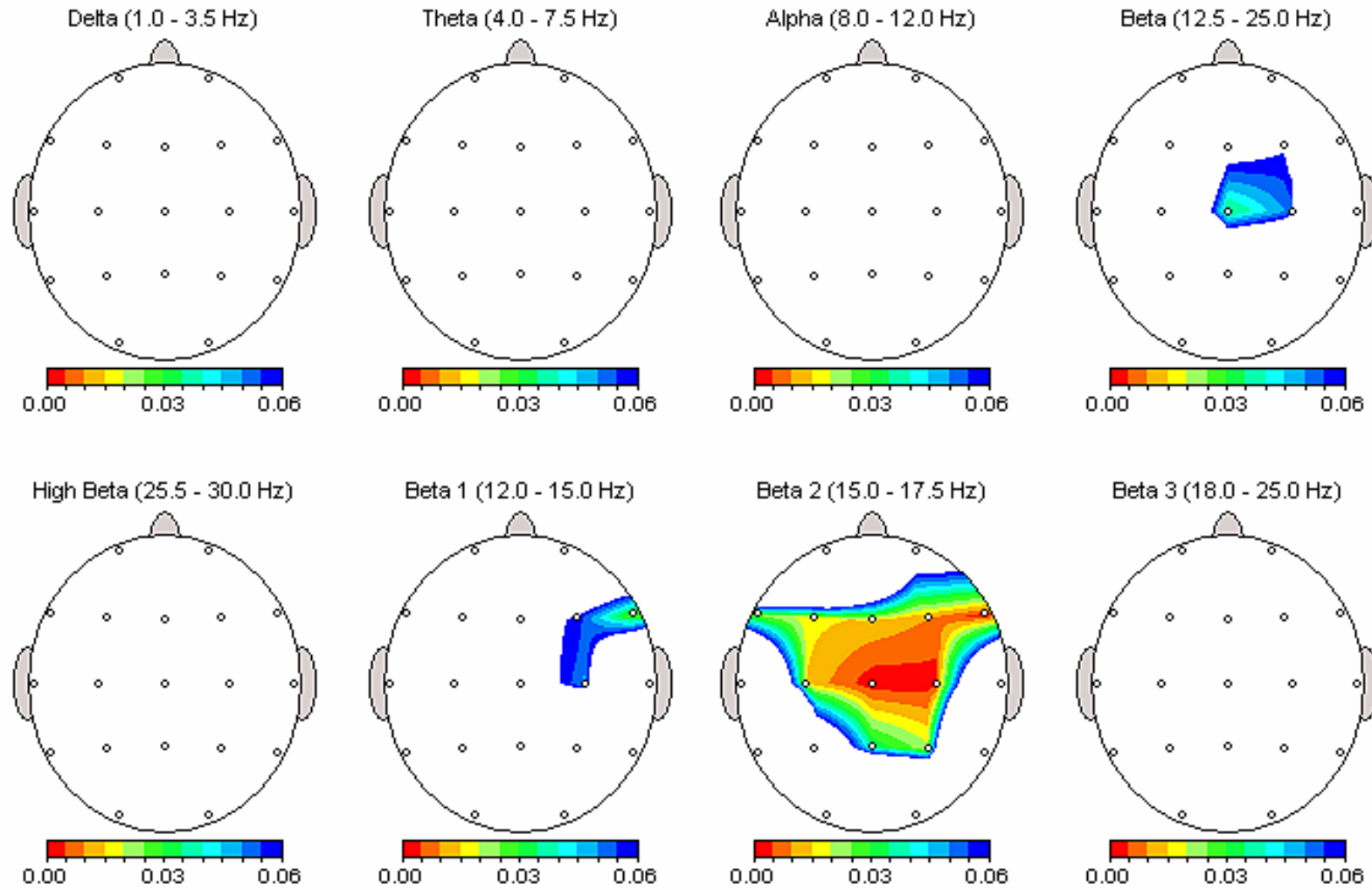
QEEG Absolute Power



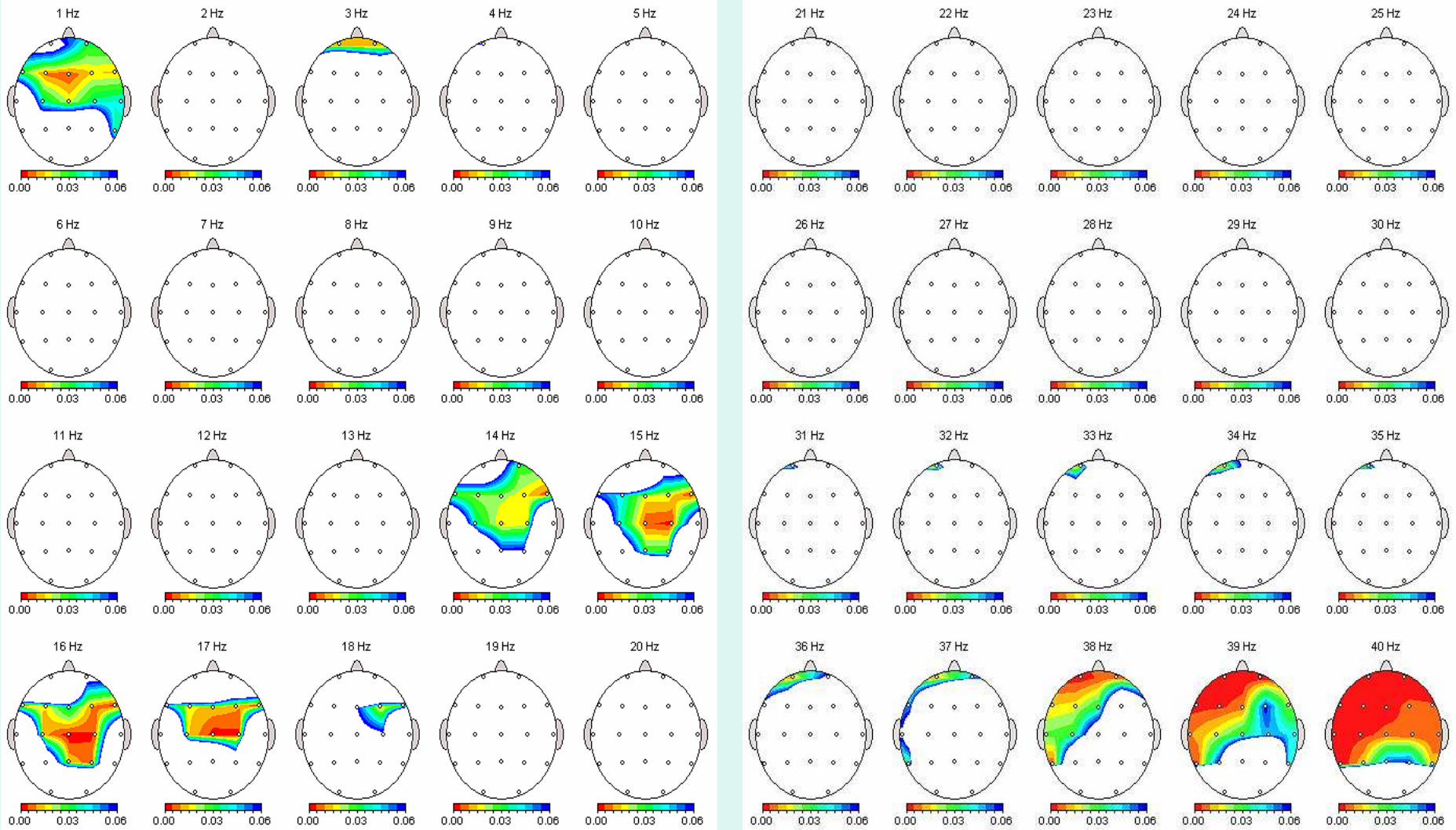
QEEG Absolute Power – Single Hz



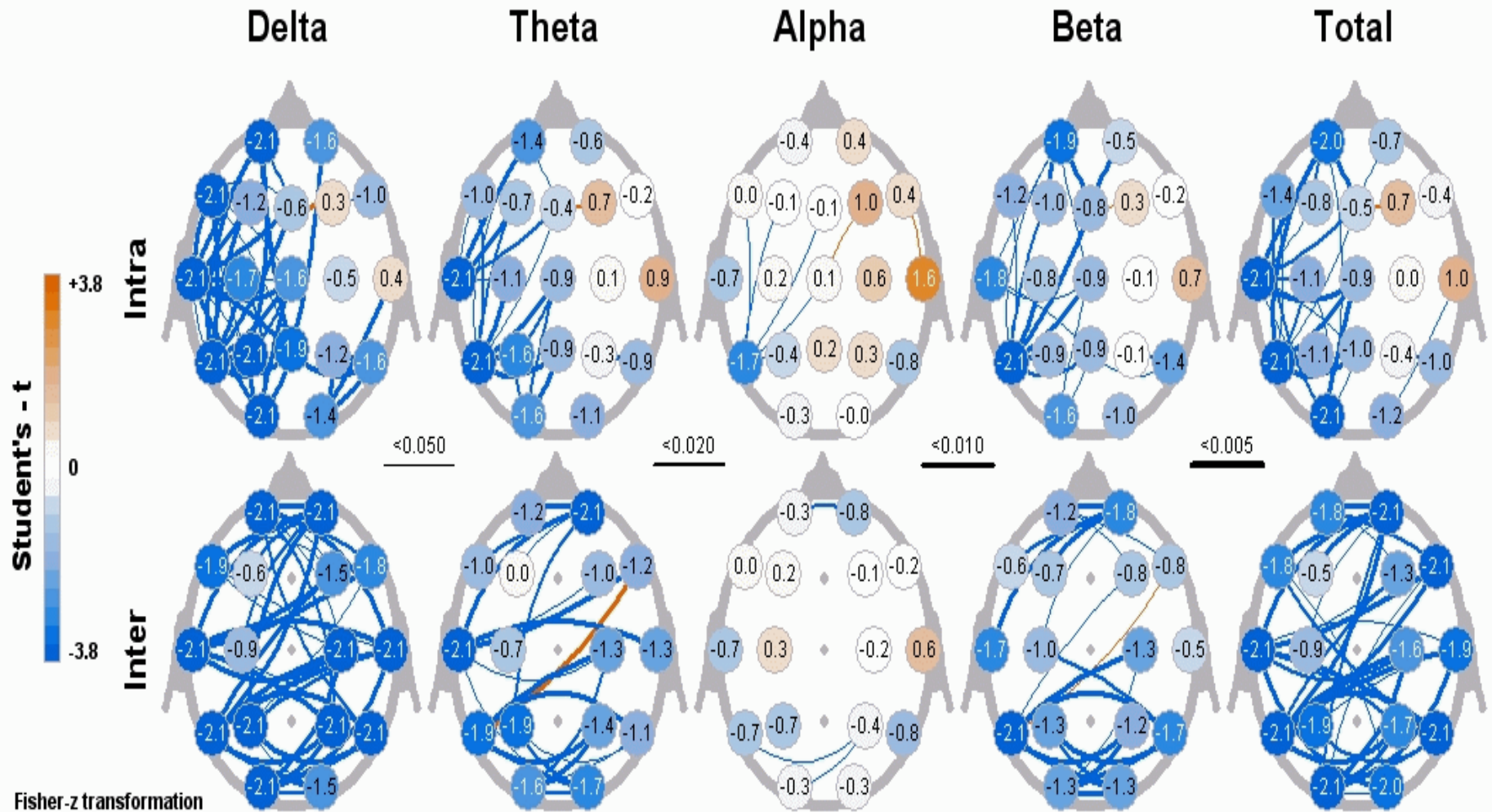
QEEG Relative Power



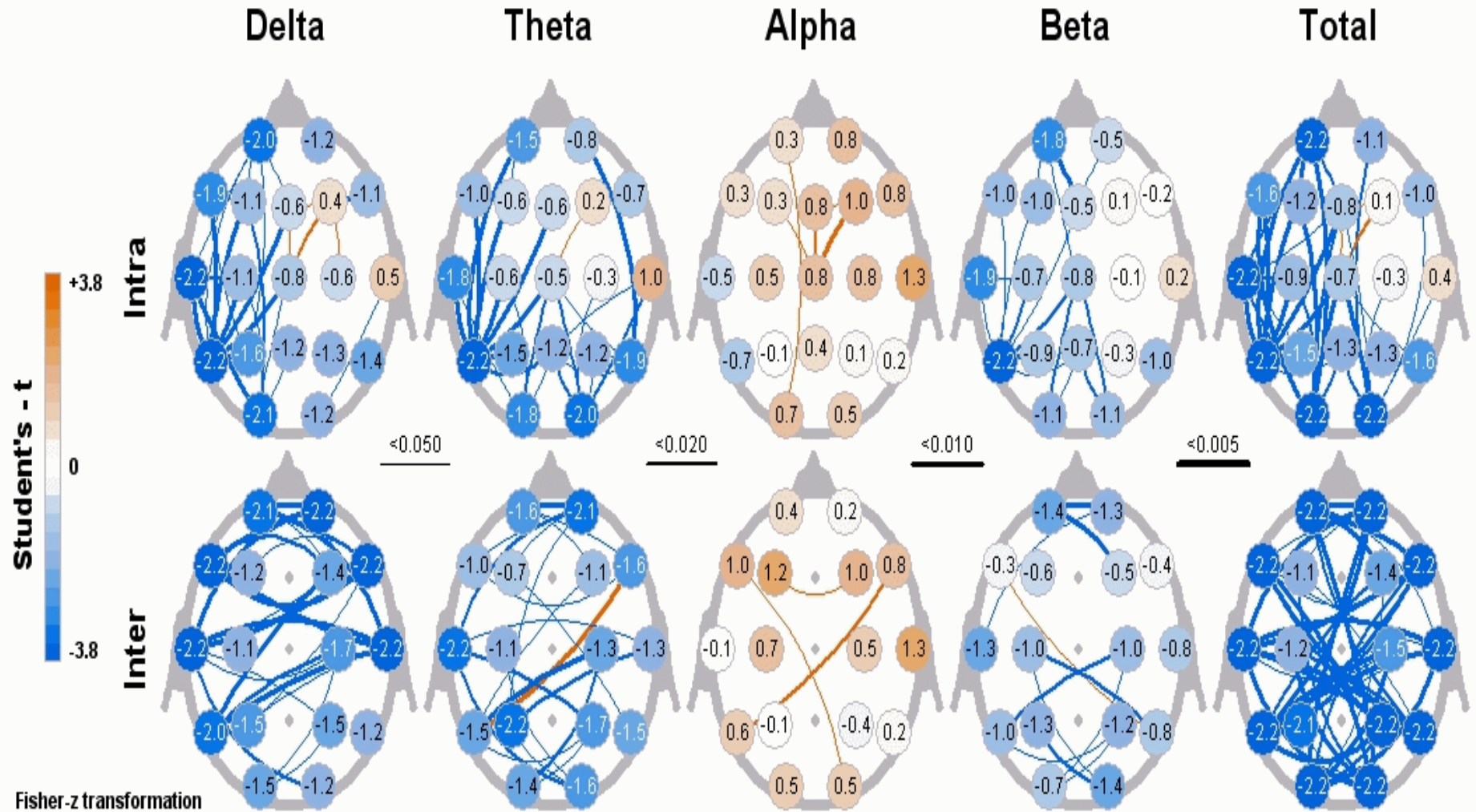
QEEG Relative Power – Single Hz



QEEG Connectivity - 27



QEEG Connectivity - 13



QEEG Connectivity - 13

ASD13PATIENTS - ASD13CONTROLS

Alpha Coherence

Two-tailed probabilities for paired t-tests with df = 12

Fisher's-z transformation

Naive alpha: $p \leq 0.0500$

Fp2	-0.143																			
F7	0.696	-0.704																		
F8	-0.891	0.444	0.941																	
F3	-0.314	-0.731	-0.743	0.542																
F4	-0.486	-0.429	0.416	-0.398	0.037															
T3	-0.516	-0.295	-0.686	-0.710	-0.519	-0.802														
T4	0.293	0.285	0.187	0.398	0.142	0.285	-0.556													
C3	0.795	0.638	0.555	0.324	0.349	0.094	-0.402	0.225												
C4	0.341	0.278	0.139	0.560	0.084	0.107	0.709	0.803	0.148											
T5	0.400	0.056	-0.408	0.012	-0.494	0.314	-0.136	0.107	-0.138	-0.312										
T6	0.512	0.624	0.233	0.459	0.525	0.937	0.405	-0.668	-0.687	-0.771	0.731									
P3	0.712	0.594	-0.756	0.348	-0.933	0.371	-0.590	-0.938	-0.844	-0.621	-0.100	-0.534								
P4	0.552	0.616	0.477	-0.876	0.410	0.575	-0.555	-0.865	0.840	-0.921	-0.066	0.482	-0.178							
O1	0.040	0.072	0.129	0.073	0.304	0.071	-0.787	0.107	-0.984	-0.376	0.243	-0.569	0.510	-0.095						
O2	0.070	0.124	0.037	0.211	0.163	0.430	0.521	0.720	-0.565	-0.743	-0.724	0.238	-0.443	0.722	-0.520					
Fz	-0.180	-0.515	0.805	0.630	0.349	0.020	-0.665	0.165	0.181	0.081	-0.885	0.776	0.601	0.286	0.144	0.250				
Cz	0.385	0.216	0.182	0.108	0.048	0.005	-0.898	0.208	0.088	0.193	-0.255	-0.356	-0.516	-0.512	-0.831	-0.311	0.017			
Pz	0.385	0.311	0.410	0.286	0.284	0.102	0.969	0.716	0.142	0.498	-0.470	-0.954	-0.777	-0.218	-0.274	-0.119	0.126	-0.974		
	Fp1	Fp2	F7	F8	F3	F4	T3	T4	C3	C4	T5	T6	P3	P4	O1	O2	Fz	Cz		