

Brain Electrical Activity Mapping in Schizophrenic Patients

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This study was carried out in Zagazig University Hospital on 10 acute schizophrenic patients with duration of illness (6months-2 years), 10 chronic schizophrenic patients with duration of illness (3-7years) and 10 healthy persons as control group, patients were free from medication at least 2 weeks before their study, all were free from neurological medical disorders, or psychotropic medication.

All subjects were subjected to full psychiatric history including DSM-IV criteria for diagnosis of schizophrenia and mental state examination, full medical and neurological examination to exclude organicity -EEG mapping using the neurometric EEG feature extraction methods.

Our study revealed that schizophrenic patients (both acute and chronic) showed statistically significant increased relative power in delta, theta and beta frequency bands and statistically significant decreased relative power in alpha frequency band when compared to control.

Chronic schizophrenic patients showed that increased frontal delta, theta and beta, central theta, temporal theta and beta, occipital beta and relatively increased alpha frequency bands while acute schizophrenic showed that increased central delta and beta, parietal theta, temporal and significant decreased alpha band.

Schizophrenic patients showed statistically significant increased F7-F8, F3-F4 coherence in alpha band, increased T5-T6 coherence in delta band and increased O1-O2 in delta and beta bands when compared to control.

Also there are significant differences between acute and chronic schizophrenics in interhemispheric coherence, as increased F7-F8 coherence in alpha band, T5-T6 in delta band, O1-O2 in delta and beta bands were most marked in chronic patients .

While increased coherence of F3-F4 in alpha band was most marked in acute patients.

(Egypt.J. Psychiat.,1996, 19:107-116).

Introduction

Of all the major psychiatric syndromes, schizophrenia is much the most

different to define and describe. The main reason for this difficulty is that over the past 100 years, many widely divergent concepts of schizophrenia have been held in different countries and the radical differences of opinion persist to the present day (Gelder et al., 1993).

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Many factors which play an important role in causation of schizophrenia which are the biological and psychological factors, recently an increasing amount of research has implicated a pathophysiological role for certain areas of brain.

Among the pathophysiological factors which are implicated in causation of schizophrenic is the electrophysiological role, and in an attempt to detect the electrophysiological differences in schizophrenic patients, we perform brain electrical activity mapping technique which presents one of the most important routes in the study of schizophrenia and there is abundant evidence that schizophrenic patients demonstrate quantitative EEG (brain mapping) abnormalities compared with normal population, (Klass and Daly, 1979).

A recent study by Takizawa et al, (1994) indicate that schizophrenic patients were found to have slower activity (Delta and Theta) than the controls. These differences were most marked in the frontal region for delta bands and in occipital region for theta bands. The schizophrenic patients also had more beta-1 activity particularly in the occipital leads. Conversely they had less alpha-2 activity over all region examined. This findings indicate cerebral dysfunction in schizophrenia and in line with the hypothesis of the hypofrontality in this disorder.

The relative increase in alpha activity in sfrontal region in schizophrenic patients is consistent with data from neuropsychological tests, metabolic imaging studies and evoked potentials studies that suggest impaired activation of frontal brain areas in patients with schizophrenia (Kahn et al., 1993).

Aim of Work

This work aims to detect the quantitative EEG (Brain mapping) abnormalities in schizophrenic patients.

-To compare Q-EEG in acute schizophrenia and chronic schizophrenia.

Subjects and Methods

This study was carried out in Zagazig University Hospital in the period of September to December 1995.

Our subjects consisted of three groups:

- A) Acute schizophrenic group.
- B) Chronic schizophrenic group.
- C) Control group.

A) Acute schizophrenic group

This group of 10 schizophrenic patients (5 males- 5 females) their age ranged 20-40 years, and duration of illness range between 6 months to two years.

They were chosen from out patients clinic and in patients department of psychiatry.

All patients met DSM- IV criteria for schizophrenia, free from psychotropic medication two weeks at least before the study and also free from any neurological or medical disorders.

B) Chronic schizophrenic group

This group fulfilled the same criteria of acute schizophrenic group as mentioned above except their duration of illness range between 3-7 years.

c) Control group

This group consisted of 10 normal subjects (5 males-5 females), their age range between 20-40 years, all subjects are free from medication, mental, neurological and medical disorders before their study.

They were selected from the employers and workers at the Zagazig University Hospital.

Methods

All subjects were subjected to:

1- Full psychiatric history taking including DSM-IV criteria for diagnosis of schizophrenia and mental state examination.

2- Full medical and neurological examination to exclude any organic causes.

3- Quantitative EEG (Brain mapping).

The quantitative EEG was carried out using a Cadewel 32- D/B system.

* Data analysis

Neurometric EEG feature extraction method (John et al., 1987). One to two minutes of artifact free data were extracted from the EEG record for quantitative analysis, with the aid of a computerized artifact detection algorithm. All epochs selected for analysis were visually reviewed to exclude any artifacts which eluded this algorithm.

The net result of BEAM data analysis for each of the following frequency band (delta, theta, alpha, beta) was expressed as follows:

1- Digitally expressed as

A- Relative power (percent power of each frequency band to the total EEG power) of each delta, theta, alpha, beta frequency bands.

B- Interhemispheric coherence (synchronization of the delta, theta, alpha, beta frequency bands).

2- Topographical expressed.

- Statistical analysis:

Data were coded entered to an Epi info file using Epi info version b.2, CDC oct. (1994) software program. Data were checked for normality and variabilities were computed for all variable, t-test, ANOVA and F-test were used.

Results

1) Analysis of topographic distribution of relative power in each frequency bands:

A- Comparison between schizophrenic patients and normal controls (Tables 1-2).

Delta band:- Schizophrenic patients showed statistically significant increase relative power in Δ band, 100% of patients over the frontal region, 85% of patients over the central region and 75% of patients over the temporal region.

Theta band:- Schizophrenic patients showed statistically significant increased relative power in θ band when compared to normal controls over the frontal region 65%, temporal region 60% and parietal region 60% of patients.

Alpha band:- There was significant decrease relative power of α band among schizophrenic patients than control, 75% of patients over the central region and 90% of patients showed decrease a power over the occipital region.

Beta band:- The increased relative power of β band among schizophrenic patients, 45% of patients over the frontal region, 60% of patients over the central region, 85% of patients over the temporal region and 75% of patients over the occipital region, with statistically significant difference compared to normal control.

B- Comparison between acute schizophrenic, chronic schizophrenic patients and control (Tables 1-3).

Delta bands:- Both acute and chronic schizophrenic patients showed increase in Δ band, with increase mean frontal Δ band in chronic patients than acute patients while in central and temporal regions, acute schizophrenics showed increase in mean Δ than chronic, with significant different compared to control.

Theta bands: There was significant difference in θ band in chronic schizophrenic than others over frontal region 70% of chronic patients, over temporal region 60% of chronic patients while over parietal region acute schizophrenic showed increase in θ band 60% of acute patients, with significant difference compared to control.

Alpha band: Chronic schizophrenic showed statistically significant increase in ∞ band than acute schizophrenic and control, 80% of chronic patient over frontal region, 70% over central region, 80% over temporal region, 50% over parietal region and 90% over occipital region.

Beta band: Chronic schizophrenic patients showed increased relative power in β band 40% over the frontal, 80% over the temporal and 70% over the occipital regions while acute schizophrenic patients showed increased β relative power over central region 60% of patients with significant difference than others.

2 - Analysis of interhemispheric coherence in each frequency band

a- Comparison between schizophrenic patients and normal control (Tables 4a,4b).

There were significant increased F7-F8 and F3 - F4 coherence in ∞ band among schizophrenic patients control.

Also schizophrenic patients showed increased T5-T6 coherence in Δ band and O1-O2 coherence in Δ and β bands with significant difference compared to normal.

While in Fp1- Fp2, C3-C4, T3-T4 and P3-P4 coherence there was no significant difference compared to normal group.

b- Comparison between acute schizophrenic, chronic schizophrenic patients and normal control.

Both acute and chronic schizophrenic patients showed increase F7-F8 coherence in ∞ band and also in F3-F4 coherence in ∞ band mainly among acute schizophrenic patients with significant difference to control group.

As regard Δ band chronic schizophrenic patients mainly showed increase T5-T6 and O1-O2 coherence with significant difference to others. Also at O1-O2 coherence both acute and chronic schizophrenic patients (chronic more than acute patients) showed increase in β band with significant difference to control.

Table 1
Percentage of Abnormal Power Among Schizophrenic Patients

Patients	Sites	F				C				P				T				O			
		Δ	θ	α	β	Δ	θ	α	β	Δ	θ	α	β	Δ	θ	α	β	Δ	θ	α	β
Acute Schizophrenia	No	10	6	7	5	9	-	8	6	-	6	4	-	8	5	5	9	-	-	9	8
	%	100	60	70	50	90	-	80	60	-	60	40	-	80	50	50	90	-	-	90	80
Chronic Schizophrenia	No	10	7	8	4	8	-	7	6	-	6	5	-	7	7	8	8	-	-	9	7
	%	100	70	80	40	80	-	70	60	-	60	50	-	70	70	80	80	-	-	90	70
Total	No	20	13	15	9	17	-	15	12	-	12	9	-	15	12	13	17	-	-	18	15
	%	100	65	75	45	85	-	75	60	-	60	45	-	75	60	65	85	-	-	90	75

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Table 2

Analysis of Topographic Distribution of Relative Power in Each Frequency Bands Among Schizophrenic Patients and Controls

Groups	F				C				P				T				O			
	Δ	ϕ	α	β	Δ	ϕ	α	β	Δ	ϕ	α	β	Δ	ϕ	α	β	Δ	ϕ	α	β
Schizo X	43.68	27.88	25.11	18.19	33.84	27.29	26.99	18.42	18.61	25.61	46.36	14.4	24.87	24.41	38.8	18.81	22.10	29.99	45.62	25.24
Phrenic $\pm$ S.D																				
X	± 2.69	± 2.57	± 6.23	± 1.76	± 2.91	± 3.27	± 5.51	± 1.56	± 2.23	± 4.79	± 1.77	1.51	± 4.82	± 3.79	± 8.79	± 2.36	± 2.36	± 4.83	± 9.7	± 3.0
Control $\pm$ S.D	29.87	23.91	29.54	19.66	25.38	25.62	33.43	14.2	1.95	17.03	47.11	13.62	21.2	19.01	39.08	16.5	29.87	13.08	54.28	12.83
	± 2.52	1.94	± 3.19	± 1.48	± 2.57	± 4.74	2.25	1.40	± 1.43	± 0.92	± 1.41	1.71	± 1.83	± 2.59	± 2.65	± 1.86	2.52	± 0.96	± 4.27	± 1.09
T-P	S	S	NS	S	S	NS	S	S	NS	S	NS	NS	S	S	NS	S	NS	NS	S	S

Table 3

Comparison Between Acute Schizophrenia, Chronic Schizophrenia and Normal Control According of Topographic Distribution of Relative Power in Each Frequency Bands

	F				C				P				T				O			
	Δ	ϕ	α	β	Δ	ϕ	α	β	Δ	ϕ	α	β	Δ	ϕ	α	β	Δ	ϕ	α	β
Acute X	38.64	25.87	19.58	18.1	43.44	25.94	23.23	18.35	21.62	29.51	40.41	14.45	24.65	22.1	31.26	18.57	16.51	14.22	36.28	24.46
Schizo $\pm$ S.D	± 2.11	± 1.85	± 2.47	± 1.60	± 2.96	± 1.69	± 3.41	± 2.23	± 4.95	± 1.93	± 3.56	± 1.37	± 3.4	± 2.22	± 2.83	± 1.91	± 5.51	± 2.471	± 1.61	± 2.93
Chronic X	42.71	29.89	30.64	18.27	33.24	28.63	39.75	17.49	19.6	21.71	50.85	15.03	21.09	26.72	46.36	19.06	17.69	5.75	54.23	26.01
Schizo $\pm$ S.D	± 1.27	± 1.25	± 2.83	± 1.45	± 2.87	± 3.96	± 4.60	± 0.87	± 1.28	± 3.32	± 4.84	± 1.66	± 2.64	± 3.67	± 5.34	± 2.82	± 1.12	± 1.84	± 4.27	± 3.02
Control X	29.87	23.91	29.54	16.66	25.38	25.62	33.43	14.2	19.5	17.03	47.11	13.62	21.2	19.01	39.08	16.5	14.66	13.08	54.28	12.83
$\pm$ S.D	± 2.52	± 1.94	± 3.19	± 1.48	± 2.57	± 4.74	2.25	± 1.40	± 1.43	± 0.917	± 1.41	± 1.71	± 1.83	± 2.59	± 2.65	± 1.86	± 1.74	± 1.95	± 4.27	± 1.09
F-P	S	S	S	S	S	NS	S	S	NS	S	S	NS	S	S	S	S	NS	NS	S	S

Table 4 (a)

Comparison Fp1- Fp2 / F7- F8 / F3- F4 / C3- C4 Coherence in Each Frequency Bands Between Schizophrenic Patient and Control

Groups	Fp1- Fp2				F7- F8				F3- F4				C3- C4			
	Δ	ϕ	α	β	Δ	ϕ	α	β	Δ	ϕ	α	β	Δ	ϕ	α	β
Schizo.Pat X	86.01	84.25	89.64	79.11	34.62	34.63	60.20	28.73	80.93	82.07	88.29	71.8	85.11	72.89	65.59	65.28
$\pm$ S.D	± 5.58	± 5.94	± 5.45	± 5.43	± 14.55	± 9.41	± 10.13	± 7.54	± 5.84	± 6.07	± 8.08	± 10.14	± 5.64	± 12.51	± 7.12	± 7.41
Control X	84.14	84.4	83.97	73.93	52.47	29.61	49.94	27.64	97.04	72.78	80.17	61.15	73.74	75.07	65.68	52.44
$\pm$ S.D	± 4.45	± 3.23	± 21.66	± 5.43	± 1.8	± 2.14	± 4.37	± 2.33	± 8.06	± 16.71	± 18.49	± 2.05	± 17.56	± 4.88	± 6.96	± 4.65
T-P	NS	NS	NS	NS	NS	NS	S	NS	NS	NS	S	NS	NS	NS	NS	NS

Table 4 (b)
Comparison T3-T4/T5-T6/P3-P4 Ep/O1-O2 Coherence in Each Frequency Bands Between Schizophrenic Patient and Control

Groups	T3-T4				T5-T6				P3-P4				O1-O2			
	Δ	θ	α	β	Δ	θ	α	β	Δ	θ	α	β	Δ	θ	α	β
Schizo X	26.83	17.41	22.69	13.09	89.47	36.35	32.85	18.87	81.72	75.67	69.34	63.42	95.88	81.01	79.41	93.81
$\pm$ S.D	± 6.40	± 4.93	± 4.50	± 5.09	± 12.75	± 7.38	± 17.79	± 5.79	± 6.19	± 7.2	± 5.92	± 7.09	± 3.77	± 5.72	± 7.57	± 7.09
Control X	24.1	16.16	19.34	12.75	50.5	33.04	29.29	16.96	80.83	75.68	66.3	60.63	80.39	77.17	77.22	66.61
$\pm$ S.D	± 4.6	± 4.24	± 2.29	± 3.2	± 6.46	± 4.17	± 2.87	± 2.44	± 5.94	± 4.33	± 6.99	± 3.75	± 7.48	± 6.07	± 5.87	± 5.28
T-P	NS	NS	NS	NS	S	NS	NS	NS	NS	NS	NS	NS	S	NS	NS	S

Table (5a)
Comparison Fp1-Fp2/F7-F8/F3-F4/C3-C4 Coherence in Each Frequency Bands Between Acute Schizophrenia, Chronic Schizophrenia and Their Control Group.

Groups	Fp1-Fp2				F7-F8				F3-F4				C3-C4			
	Δ	θ	α	β	Δ	θ	α	β	Δ	θ	α	β	Δ	θ	α	β
Acute X	87.13	84.03	89.79	78.45	43.05	32.97	59.84	29.74	79.67	82.97	89.03	72.07	74.38	69.16	66.77	55.64
Schizo $\pm$ S.D	± 5.12	± 4.96	± 5.06	± 8.78	± 9.08	± 4.32	± 9.69	± 7.57	± 5.1	± 4.82	7.26	10.317	± 5.68	± 16.68	± 5.91	± 6.89
Chronic X	84.89	84.46	89.49	79.76	35.19	31.28	60.55	27.72	82.18	81.16	82.54	71.55	73.84	76.62	64.4	56.9
Schizo $\pm$ S.D	± 6.06	± 7.06	± 6.09	± 8.51	± 19.06	± 8.78	± 11.07	± 7.77	± 6.52	± 7.62	± 9.16	± 10.5	± 5.812	± 4.57	± 8.31	± 8.21
Control X	84.14	84.4	83.97	73.93	82.47	29.61	49.94	27.64	79.04	72.78	80.17	61.15	73.74	75.07	65.68	52.44
$\pm$ S.D	± 4.45	± 3.23	± 21.66	± 5.43	± 1.8	± 2.14	± 4.37	± 2.33	± 8.06	± 16.71	± 18.49	± 2.05	± 17.56	± 4.88	± 6.96	± 4.65
T/P	NS	NS	NS	NS	NS	NS	S	NS	NS	NS	S	NS	NS	NS	NS	NS

Table (5b)
Comparison T3-T4/T5-T6/P3-P4 Ep/O1-O2 Coherence in Each Frequency Bands Between Acute Schizophrenia, Chronic Schizophrenia and Their Control Group

Groups	T ₃ -T ₄				T ₅ -T ₆				P ₃ -P ₄				O ₁ -O ₂			
	Δ	θ	α	β	Δ	θ	α	β	Δ	θ	α	β	Δ	θ	α	β
Acute X	26.37	17.85	23.02	15.98	86.22	39.60	37.44	20.99	88.72	77.11	69.82	63.58	89.55	83.23	82.84	93.1
Schizo $\pm$ S.D	± 7.73	± 5.25	± 4.46	± 6.76	± 17.19	± 7.60	± 6.67	± 6.61	± 4.75	± 8.07	± 5.36	± 8.5	± 0.038	± 5.9	± 5.92	± 9.41
Chronic X	26.28	16.97	22.36	10.19	92.72	33.10	22.26	16.74	80.71	74.23	68.65	63.25	96.21	78.78	75.98	94.52
Schizo $\pm$ S.D	± 5.12	± 4.84	± 4.76	± 1.3	± 4.89	± 5.81	± 6.54	± 4.13	± 7.5	± 6.22	± 9.69	± 6.44	± 3.26	± 4.82	± 7.73	± 4.06
Control X	24.1	16.16	19.34	12.75	50.5	33.04	29.29	16.96	80.83	75.68	66.3	60.63	80.39	77.17	77.22	66.61
$\pm$ S.D	± 4.6	± 4.24	± 2.29	± 3.2	± 6.46	± 4.17	± 2.87	± 2.44	± 5.94	± 4.33	± 6.99	± 3.73	± 7.48	± 6.07	± 5.87	± 5.78
F/P	NS	NS	NS	NS	S	NS	NS	NS	NS	NS	NS	NS	S	NS	NS	S

Discussion

During the past two decades, many evidences have accumulated suggesting a link between mental disorders especially schizophrenia and electrophysiological abnormalities. One of the most extensively studied subjects is the brain electrical activity mapping in schizophrenic.

The data presented in this study indicate that certain global features of pathophysiology are shared by a high proportion of schizophrenics. The findings demonstrate a number of important points.

1-Relative power

A- Patients versus control.

Increased relative power in delta frequency band in frontal region and theta frequency band were most marked anteriorly in our patients. Saletu et al.(1990) and John et al.(1994) reported the same findings.

These can be explained through Buchsbaum et al.(1982) and Fiddle et al. (1992), as excessive delta and theta frequency bands in frontal region may be related to the reduction of cerebral blood flow and neuronal metabolic activity in frontal cortex in schizophrenic patients and are in line with the hypothesis of hypofrontality in schizophrenic disorder.

Mayauchi et al.(1990) and Nagase et al.(1992) found that decreased relative power in alpha frequency band were most marked particularly over the occipital region in schizophrenic patients, we also found the same result in our patients.

The observed increase in theta frequency band and decrease in alpha frequency band suggests a true slowing of alpha rhythms into the theta frequency range, rather than augmentation of some independent theta generator as is seen in cognitive impairment of elderly patients (John and Pritchep, 1990).

Decreased alpha power most marked in occipital as well as central and temporal regions in schizophrenic patients reflect a dysfunction of basal ganglia and diencephalon, two main contributors to the alpha rhythms (Zec and Weinberger, 1986).

Increased relative power in beta frequency band particularly over the occipital as well as temporal regions in our patients. This agree with the findings of (Saletu et al.,1990). (Takizawa et al., 1994) and (Dierks et al.,1995). But contradict Guenther and Breiting (1985), who reported increased beta activity over parietoccipital region and John et al., (1994) who stated a beta defect most marked in parietal region.

The excessive beta activity particularly over the occipital region (post central) is consistent with the relatively increased blood flow in both central regions reported in schizophrenic patients using the cerebral blood flow technique (Mathew et al.,1988), these results suggest that the posterior region in schizophrenic may be demonstrate elements of irritability (Morihiya et al.,1983).

B- Patients versus patients

This study revealed that, acute schizophrenic patients recorded increased relative power in delta and theta frequency bands were most marked in frontal region and beta band was most marked posteriorly and decrease relative power of alpha band in all regions.

These findings go hand in hand with the report of (Miyauchi et al.,1990) and contradict (John et al.,1994).

Chronic schizophrenic recorded increased relative power in delta and theta frequency bands were marked in frontal region and beta band was marked posteriorly, the same results reported by (Saletu et al.,1994) and (Takizawa et al., 1994). Also chronic schizophrenic patients

showed relatively increased alpha frequency band in all regions examined. This agrees with the report of (Kahn et al., 1993).

2- Interhemispheric coherence

A- Patient versus control

The finding of increased F7-F8 and F3-F4 coherence in alpha band among schizophrenic patients is similar to previous report by (John 1994), and indicate that the anterior regions were abnormally pre-empted by each other and there is anterior hypercoherence, suggesting poor excess or sensory information to region concerned with evaluation of sensation, these findings are highly reminiscent of the pioneering observation of Gavrilova (1970).

(Nagase et al., 1992) reported that there was T5-T6 hypercoherence in delta band in schizophrenic patients, also our patients recorded the same findings.

The increased coherence between homologous temporal region in delta band is of particular interest as these electrodes overlie Heschl's gyrus which one might expect to be activated during auditory hallucinations (John et al., 1994).

This study also revealed increased O1-O2 coherence in delta and beta bands in schizophrenic patients, these findings agree with (Nagase et al., 1992) but contradict (John et al., 1994).

B- Chronic schizophrenic versus acute schizophrenics.

The hypercoherence of F7-F8 in alpha band, T5-T6 in delta band, and O1-O2 in delta and beta bands were most marked in chronic schizophrenic patients than acute schizophrenic patients.

While the hypercoherence of F3-F4 in alpha band was most marked in acute schizophrenic patients than chronic patients. The same results reported by Nagase et al. (1992).

The difference between acute and chronic schizophrenics in relative power and interhemispheric coherence may be due to long history of illness under go structural changes or changes in the levels of synthesis of certain neurotransmitter or long medication history among chronic patients than acute patients that alter these physiological features (John et al., 1994).

Recommendations

Researchers interested our topic (Brain electrical activity mapping in schizophrenia) might have better serendipity.

They are going to

- Study this topic in drug on schizophrenic patients and comparing their results with schizophrenics on/off medication.

- Study this topic in large sample of patients.

- Conduct longitudinal study that might permit them to observe electrophysiological changes over time in individual patients with their changes in their symptomatology.

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L'activité du cerveaux électro-physiological chez les schizophrénies

Une comparaison a été faite sur 30 malades . Schizophrénies (diagnostiqués selon DSM-IV) et 10 normal volontaires pour comparer les changements de l'activité du cerveaux chez les 2 groupes, et les résultats ont soulignés de significantes différences entre les deux groupes.

تخطيط المخ بالموجات الكهروفسىولوجية لمرضى الفصام

أجريت هذه الدراسة بمستشفى الزقازيق الجامعى على عينة شملت ثلاثون شخصاً منهم عشرة مرضى فصام حديث يتراوح التاريخ المرضى لهم من ٦ أشهر إلى سنتين. وعشرة مرضى فصام مزمن يتراوح التاريخ المرضى لهم ثلاث إلى سبع سنوات. بالإضافة إلى عشرة أشخاص أصحاء كمجموعة ضابطة وكل الذين أشتملت عليهم الدراسة كانوا بدون مشاكل طبية أو عصبية أو تحت تأثير أدوية.

ولقد تم إيقاف العلاج للمرضى لمدة أسبوعين قبل بدء الدراسة.

وتم عمل ما يلى لكل الذين شملتهم الدراسة : التاريخ النفسى الكامل مشتملاً على ما يخص تشخيص الفصام وفحص الحالة العقلية مع كشف طبي وعصبى كامل وذلك لإستبعاد الأسباب العضوية على التغيرات الكهروفسىولوجية.

وكانت أهم نتائج هذه الدراسة هى زيادة موجات دلتا وبيتا بشكل ملحوظ فى الفص الأمامى وزيادة موجات بيتا بشكل ملحوظ فى الفحص ونقص موجات ألف بشكل ملحوظ بالفص الخلفى وذلك فى مرضى الفصام كمجموعة واحدة عنه عند المجموعة الضابطة وذلك ذو دلالة إحصائية. ولوحظ أيضاً وجود إختلاف ذو دلالة إحصائية بين مرضى الفصام المزمن والحديث وأهمها الزيادة النسبية فى موجات ألفا بالنسبة لمرضى الفصام المزمن ونقصها فى مرضى الفصام الحديث وقد لوحظ أيضاً الزيادة فى معدل الارتباط والتزامن لموجات ألفا فى الفص الأمامى وزيادة معدل الارتباط والتزامن لموجات دلتا وبيتا فى الفص الخلفى.