

ГОСУДАРСТВЕННОЕ ПРЕДПРИЯТИЕ
Психоневрологический НИИ им. В.М. Бехтерева
Лаб. нейро- и психофизиологии

УТВЕРЖДАЮ
Зам. директора по науке



проф. Ю.В. Попов

REPORT

**On testing the clinical and neurophysiological effect of the Optical Filters
bearing fractal matrix topology**

**St. Petersburg
2002**

REPORT

On testing the clinical and neurophysiological effect of the Optical Filters bearing fractal matrix topology

The Reasons for Conducting the Medical Trials

A resolution of the Commission on Physiological Devices and Apparatus for Diagnostics of the Human Organism's Functional State by the Physiological Indices of Reflective Zones and Biologically Active Points (BAP) and for Reflexotherapy of BAP, the Committee on New Medical Equipment of the Russian Federation Ministry of Public Health, to institute the medical trials (Minutes #3, July 14, 2000).

Time and Place of Conducting the Medical Trials

The medical trials were conducted at the laboratory for neuro- and psychophysiology of the Psychophysiology Research Institute named after V. M. Bekhterev from December 1, 2001, till March 30, 2002.

A Brief Description of the Optical Filters

The AIRES Matrix Synchronizers of the Functional Activity of the Human Central Nervous System, or the Optical Fractal Matrix Filters (further referred to as OFs) is designed to correct disorders of the human CNS by influencing the CNS through the visual system.

The OFs present Fourier filters of spatial frequencies and are graphically synthesized holograms which create a volumetric structure in nanochromatic light consisting of collimated beams intersecting at a single point of space. The OFs can increase the image contrast and causes a spatial neutralization that removes a constant component in a signal (adaptation), while the relief of illumination is described as a pattern consisting of illuminated parts of varying intensity relative to an average level.

The OFs were presented in two kinds of topological scheme:

- 1) The dark-field OF designated as CX2 has a topological scheme which is a continuous field composed of unit basic modules that are of size 5×5 mm and have the topological line of width 4 μm .
- 2) The bright-field OF designated as CX3 has another topological scheme which is composed of a unit basic module that is of diameter 66.56 mm and has the topological line of width 4 μm .
- 3) And the placebo spectacles which were made of ordinary glass.

1. Purpose of the Medical Trials

The purpose of the medical trials was to evaluate the effect of the OFs on the electrical activity of the human brain for which purpose the electroencephalographic method was used.

Investigation Subjects and Procedure

1.1 Patients of the Neurosis Department of the Psycho-Neurologic Hospital, who had anxious asthenic syndrome, were involved in the investigation.

1.2 EEG recordings were taken in standard conditions: a sound-proof, dark chamber protected from electric fields. To take into account the psychoemotional state of the patients, the EEG recordings were taken three times.

1.2.1. The first recording of the background EEG was taken for the purpose of decreasing the situation anxiety which, as a rule, increases in an unfamiliar environment and destabilizes the EEG indices.

1.2.2. The second EEG-recording was taken when a stable EEG pattern was achieved. An interval was made between the recordings if necessary for the reasons of a patient's psychoemotional state. During the second recording, both the background EEG (5-7 minutes) and the reaction to functional loads (opening eyes, etc.) was registered:

- Background EEG (5-7 minutes)
- Opening eyes reaction (two times)
- Photostimulation at frequencies 3, 6, 9, 12, 15, and 18 Hz (8 seconds each frequency. Intervals between each stimulation were no less than 10 seconds.)
- Hyperventilation (2-3 minutes).
- Background EEG (no less than 1 minute)

When taking the second EEG-recording, special attention was given to the presence (or absence) of local variations and pathological rhythms, including signs of paroxysmal activity, against the background and in consequence of hyperventilation.

1.2.3. The third EEG-recording was taken after a 2- or 3-hour interval, after which the patients looked at a lamp through the OFs or the placebo-spectacles.

1.2.4. To analyze the EEG-recordings, sites no shorter than 30 sec. which were most free of artifacts were chosen. In both the second and third EEG-recording, some parts of the recordings were omitted from the statistical processing because they included pronounced EEG-artifacts which were caused by behavioral and physiological factors, such as spontaneous motoric reactions, frequent eyeball movements, the galvanic skin resistance. The data processing was performed with the use of both the standard program of the "Telepat" encephalograph and the mathematical computer program "Mathlab-R-12." The overall number of examined patients was 54.

1.2.5. Variations in the EEG-rhythm index in the recordings taken before wearing the OFs and during wearing the placebo-spectacles were calculated. The difference between EEG-rhythm indices was determined before and after wearing the OFs (CX2 and CX3) and the placebo-spectacles, and the reliability of difference between variations was determined in five frequency

ranges both over particular channels and over the result of summation of their respective values. Also, variations in the basic rhythm frequency over particular channels were studied, as well as variations in the contribution percentage of the basic frequency, which were calculated by the same variation technique.

1.2.6. The psychological examination of the patients was performed before the first EEG-recording and after the third one.

2. Results of the Medical Trials

First of all, we should point out that there were no local variations, and pathological rhythms and signs in the EEG of the examined patients both before and after using the OFs.

Reliable differences from the placebo-spectacles were obtained for both the dark-field spectacles and the bright-field spectacles. The basic differences referred to the left hemisphere.

So for the bright-field spectacles, the following results were obtained:

- By the index variations, it was found that the delta-rhythm index increased in both the left temporal and occipital leads, while the beta 1 index and the beta 2 index decreased in the occipital lead in the left hemisphere. In addition, the dominant frequency of the theta-rhythm increased in the parietal area of the right hemisphere.

For the dark-field spectacles, the following results were obtained:

- In the left occipital lead, the theta-index decreased, while the alpha-index increased. Also, in the occipital lead, the dominant beta 1 frequency decreased, while in the frontal lead, increased.

No statistically reliable differences were found in the effects of the three kinds of spectacles by anxiety indices in patients with asthenic and anxiety disorders. However, a tendency toward a decrease in asthenic-anxiety disorders was observed, which probably could turn to reliable values when using the OFs over a longer period of time.

3. Summary

An analysis of the data obtained reveals the following:

- Most pronounced variations while wearing the OFs were observed in the left hemisphere, which suggests that the OFs can produce a normalizing effect on the perception of the environment. It should be remarked that the variations occurred in the occipital area (the visual analyzer) and in the temporal area (the tonsil-temple area where sensory modalities converge, and a primary image is formed). Thus the OFs can influence the primary perception and—of course, with a time lag—on the ability to make situation estimate, which had an effect on both the functioning of the right hemisphere and the performance of the psychological tests.

- The effect of the CX3 OFs is aimed at decreasing tension, while that of the CX2 OFs at the activation of the cortex, both the effects producing removal of fatigue after using the OFs.
- The regional character of the OFs action points to the selectivity and specificity of the effect on the human brain. This property is economical from the point of view of the human brain resources.
- The primary effect of the CX3 and CX2 OFs on the occipital part of the brain and the added effect of the CX3 OFs on the temporal part of the brain suggest that the general influence on the cortex is exerted through the midbrain (CX2) and through both the midbrain and the interbrain (CX3). The activation of the frontal part, which is closely related to the diencephalic regulatory formations suggests that the frontal parts and cortical zones of the right hemisphere, and the diencephalic structures are stepwise involved in the development of regulatory processes in the CNS.
- To the above-said, the following observations must be added: Wearing the OFs helps remove fatigue caused by work with computers, and decrease depression in persons with reactive and endogenous depression. However, these observations call for further investigation.

4. Conclusions

The investigation revealed that using the CX3 and CX2 OFs in compliance with the prescribed instructions does not give rise to any pathological rhythms or signs. The observed regional and general variations in the CNS functional activity indicate that in the CNS, tension is decreased (i.e., relaxed), fatigue is removed, and regulatory processes are activated.

The optical filters bearing CX-2 and CX-3 topological schemes can be recommended to the Commission on Physiological Devices and Apparatus to decide the issue of serial production of the optical filters, and of their use for purposes of prophylaxis.

V. B. Slezin, Doctor of Biological Sciences

Head of Laboratory for Neuro- and Psychophysiology

Table 1**Data on nonparametric statistics (the Wilcoxon test for pair selections), and descriptive statistics on index values**

Wilcoxon Test

		N	T	Z	p-level			N	T	Z	p-level
Delta	bright-field	12	15	1.882715	0.059748	Delta	bright-field	12	11	2.196501	0.028063
	dark-field	12	35	0.313786	0.753686		dark-field	12	34	0.392232	0.694889
Theta	bright-field	12	32	0.549125	0.582923	Theta	bright-field	12	28	0.862911	0.388193
	dark-field	12	13	2.039608	0.041398		dark-field	12	34	0.392232	0.694889
Alpha	bright-field	12	27	0.941357	0.346529	Alpha	bright-field	12	27	0.941357	0.346529
	dark-field	12	11	2.196501	0.028063		dark-field	12	25	1.09825	0.272103
Beta 1	bright-field	12	15	1.882715	0.059748	Beta 1	bright-field	12	22	1.33359	0.182348
	dark-field	12	26	1.019804	0.307829		dark-field	12	32	0.549125	0.582923
Beta 2	bright-field	12	13	2.039608	0.041398	Beta 2	bright-field	12	30	0.706018	0.480182
	dark-field	12	26	1.019804	0.307829		dark-field	12	36	0.235339	0.813947
O1-A1 (occipital lead)						T3-A1 (middle-temporal lead)					

Descriptive Statistics

		Valid N	Mean	Min	Max	Std.Dev.			Valid N	Mean	Min	Max	Std.Dev.
placebo	Delta	12	-0.21167	-6.62	7.06	3.225193	Delta	Delta	12	-1.23417	-4.72	2.21	2.326013
	Theta	12	2.555833	-4.97	10.73	4.839747		Theta	12	-0.20833	-5.31	3.66	2.676024
	Alpha	12	-3.67	-15.28	12.69	8.521394		Alpha	12	0.718333	-2.87	6.16	2.860149
	Beta 1	12	1.39	-3.72	8.92	3.695211		Beta 1	12	0.566667	-2.13	5.47	2.349887
	Beta 2	12	0.600833	-1.16	4.2	1.309854		Beta 2	12	0.705833	-1.36	3.48	1.665585
bright-field	Delta	13	1.931538	-2.2	8.99	2.834345	Delta	Delta	13	1.069231	-3.11	6.48	3.051823
	Theta	13	1.559231	-4.82	10.96	4.842843		Theta	13	1.656154	-7.53	10.16	5.786301
	Alpha	13	-0.48462	-9.47	9.46	5.149032		Alpha	13	-1.43846	-8.17	9.59	4.878543
	Beta 1	13	-1.03769	-5.54	5.59	3.048817		Beta 1	13	-1.30846	-8.83	8.34	5.007175
	Beta 2	13	-0.57385	-4.76	2.24	1.78229		Beta 2	13	-0.22154	-4.05	4.21	2.536188
dark-field	Delta	14	-0.84214	-18.91	6.21	6.504359	Delta	Delta	14	-2.03571	-20.62	9.75	7.246996
	Theta	14	-0.99571	-13.24	5.56	4.51964		Theta	14	0.578571	-15.11	17.1	7.309053
	Alpha	14	3.204286	-5.79	19.53	7.20444		Alpha	14	1.948571	-5.28	11.73	4.553082
	Beta 1	14	-0.125	-5.99	9.59	3.828524		Beta 1	14	-0.46857	-18.99	15.64	8.632646
	Beta 2	14	-0.12714	-3.16	1.96	1.309418		Beta 2	14	0.961429	-3.82	7.38	3.431938

Table 2

Data on parametric statistics (the Wilcoxon test for pair selections), and descriptive statistics on values of a dominant frequency in five EEG-ranges in the occipital lead and the middle-temporal lead in the left hemisphere

		N	T	Z	p-level			N	T	Z	p-level
Delta	bright-field	12	9.5	1.83473	0.066555	Delta	bright-field	12	31	0.627572	0.530289
	dark-field	12	18	1.333663	0.182324		dark-field	12	25	1.09825	0.272103
Theta	bright-field	12	38.5	0.039223	0.968713	Theta	bright-field	12	38.5	0.039223	0.968713
	dark-field	12	17.5	1.019294	0.308071		dark-field	12	12	0.338062	0.735319
Alpha	bright-field	12	10	2.04495	0.040868	Alpha	bright-field	12	30.5	0.666795	0.504908
	dark-field	12	25.5	0.203859	0.838465		dark-field	12	32.5	0.044455	0.964542
Beta 1	bright-field	12	37	0.156893	0.87533	Beta 1	bright-field	12	24.5	0.755742	0.449809
	dark-field	12	26	1.019804	0.307829		dark-field	12	11	2.196501	0.028063
Beta 2	bright-field	12	18.5	1.289207	0.197335	Beta 2	bright-field	12	32.5	0.044455	0.964542
	dark-field	12	3	2.667325	0.00765		dark-field	12	28.5	0.400099	0.689086
F3-A1 (postfrontal lead)						O1-A1 (occipital lead)					

Descriptive Statistics

	Valid N	Mean	Min	Max	Std.Dev.			Valid N	Mean	Min	Max	Std.Dev.
Delta	12	0.125	-1.5	2	0.913908	placebo	Delta	12	-0.20833	-2.25	1.25	0.976039
Theta	12	-0.08333	-2	2	1.094061		Theta	12	0.0625	-2.25	2.75	1.197179
Alpha	12	0.166667	-0.5	1	0.503774		Alpha	12	0	-0.75	0.75	0.476731
Beta 1	12	0.354167	-4	5.75	2.485088		Beta 1	12	1.104167	-2.5	9.5	2.853344
Beta 2	12	0.770833	-1	2.5	1.115278		Beta 2	12	-0.125	-1.5	1	0.58872
Delta	13	-0.61538	-1.5	0.5	0.609092	bright-field	Delta	13	0.038462	-1.5	2	1.064807
Theta	13	0.230769	-1.25	2.5	1.062924		Theta	13	0.134615	-1.25	1.5	0.839242
Alpha	13	-0.26923	-1.5	0.75	0.649211		Alpha	13	-0.13462	-1.25	0.5	0.463404
Beta 1	13	0.75	-6.5	11	3.944933		Beta 1	13	-0.11538	-3.25	2.5	1.576571
Beta 2	13	0.692308	-2.75	4.5	1.661932		Beta 2	13	0.038462	-1.75	1.75	0.95659
Delta	14	-0.5	-2	0.5	0.727218	dark-field	Delta	14	0.142857	-1.5	1.75	0.939078
Theta	14	0.446429	-3	3.25	1.525988		Theta	14	0.160714	-2	2.75	1.081342
Alpha	14	0.017857	-2.75	2.25	1.23438		Alpha	14	0.053571	-1.5	1.75	0.747937
Beta 1	14	-0.78571	-4.75	2	1.911144		Beta 1	14	-1.03571	-5	0.75	1.810379
Beta 2	14	0.053571	-0.75	1.5	0.760684		Beta 2	14	0.071429	-1.75	2.5	1.182519

Table 3

Data on nonparametric statistics (the Wilcoxon test for pair selections), and descriptive statistics on values of a dominant frequency in five EEG-ranges in the occipital lead and the middle-temporal lead

Wilcoxon Test		Right Hemisphere				
		N	T	Z	p-level	
Delta	bright-field	12	30	0.266733	0.789677	
	dark-field	12	17.5	1.019294	0.308071	
Theta	bright-field	12	4.5	1.890378	0.058716	
	dark-field	12	17	1.725822	0.084389	
Alpha	bright-field	12	35.5	0.274563	0.783654	
	dark-field	12	17.5	1.378118	0.168176	
Beta 1	bright-field	12	38	0.078446	0.937473	
	dark-field	12	22	0.560612	0.575066	
Beta 2	bright-field	12	34	0.392232	0.694889	
	dark-field	12	23.5	1.21592	0.224024	
P3-A2						
Descriptive Statistics						
		Valid N	Mean	Min	Max	Std.Dev.
placebo	Delta	12	-0.1875	-1.5	2	1.06667
	Theta	12	-0.95833	-3	2.25	1.562462
	Alpha	12	0	-1.25	0.75	0.543557
	Beta 1	12	0.020833	-2.75	5.5	1.987056
	Beta 2	12	0.0625	-2.25	2.5	1.103327
bright-field	Delta	13	-0.36538	-1.25	1	0.7747
	Theta	13	0.134615	-2	2.75	1.102154
	Alpha	13	0.211538	-1.5	2.75	1.050031
	Beta 1	13	-4.4E-16	-2.75	6.5	2.331845
	Beta 2	13	0.269231	-0.5	1.75	0.590388
dark-field	Delta	14	0.142857	-1	1.5	0.744946
	Theta	14	0.035714	-2.75	2.75	1.48018
	Alpha	14	-0.41071	-2.25	0.5	0.823963
	Beta 1	14	0.196429	-5.25	6.5	2.840603
	Beta 2	14	-0.75	-7.75	1.25	2.093947

N is the number of subjects;

T is the rank;

Z is the parameter of simultaneous distribution (express); with normal distribution, the parameter is equal to 0;

p-level is the significance level (0.05);

Mean is the average value of a selection;

Min is the minimal value of a selection;

Max is the maximal value of a selection;

Std. Dev. is the standard deviation.

Values at the level of 0.05 and average values of the difference between dominant EEG-frequencies before and after using the OFs are highlighted yellow to show the trend of variations.