IMPROVEMENT OF PSYCHOTECHNICAL PERFORMANCES AND STRESS RESISTANCE AFTER MODULATION OF THE VDT RADIATION BY AN OSCILLATING MAGNETIC FIELD*

** Tecno AO : Magnetic Alpha Oscillator*

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INTRODUCTION

According a recent study (Bastide, 1994, Youbicier-Simo, EBEA,1996), the strong inhibition of the hormonal and immunological defences in chick embryos and young chickens exposed to a cathode ray display showed that VDU electromagnetic field is a biological chronical stress factor. Working with video display units (VDU) more than two hours per day could be the source of several neuropsychological disorders (P.Loiret 1995). Smith and coll.(1981) and Johansson and coll.(1984) showed that the VDU users develop a higher level of stress compared with office clerks effecting similar tasks. Stress ha also been shown to lower the efficiency of programmers (Zavala,1984)

The possible origins of professional stresses can be divided in factors directly linked to the type of work accomplished (difficulty of the required tasks, unadaptated working conditions, varied nuisances), in psycho-sociological factors (responsabilities, relationships with the professional group, activity control , career perspectives, job security) and in organisation-linked factors (conflicts, confusion of tasks) (Cooper 1985) Occupational stress of operators is the result of the interactive accumulation of these different technological, physical, organisation-linked and psycho-sociological factors (W.H.O.1989).

Most VDU users show both emotional (irritability, anxiety, depression) and psychosomatical (insomnia, lack of appetite, perspiration) disorders (Amick 1992) .

The study "Work with video display units TEC-2" supervised by Loiret and coll.(1994) reports that the level of neuro-psychological disorders (irritability, anxiety, sleep troubles) of workers that stay at least two hours a day, continuously or discontinuously, in front of a display screen increases with the length of the presence in front of the screen (significant statistical differences appear over 4h per day) They are accompagnied with other complaints (ophtalmological, musculoskeletal, headaches). Young workers of less than 25 years are more prone to headaches, less to neuro-psychological disorders and more disposed to ocular-visual troubles than their elders of more than 45 years.

Objectives :

° to identify in human, in this present multi-localisation controlled study, carried out in a population of 119 volounteers, VDU workers, whether the VDU electromagnetic field could be an additional stress factor in the so-called "technostress";

° to evaluate the impact of electromagnetic field as a stressor in work performance and exploratorily in occupational health complaints;

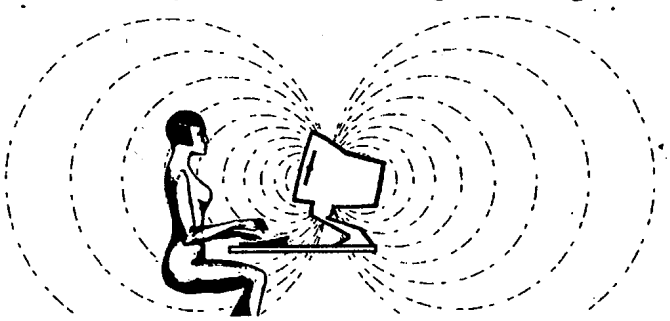
° to evaluate the protective effect of Tecno AO antenna against VDU electromagnetic field as a stressor.

METHOD AND MATERIALS

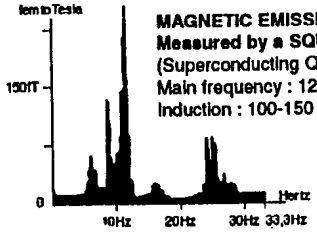
To study these parameters we used a psychometric stress test evaluating the operator's performance level before and after equiping the computer with an electromagnetic protection: Tecno AO antenna (8-12 Hz; mean level 150 fT) International patent (Fig.1)

° The device used is an autonomous magnetic oscillator made up of oscillating paramagnetic solution contained in a double antenna (17 cm long) It has been mounted at the side of the computer (cathode ray tube, color or black and white used in the tested companies offices), at the end of the first working week, after the first reference test, for the experimental period of a month.

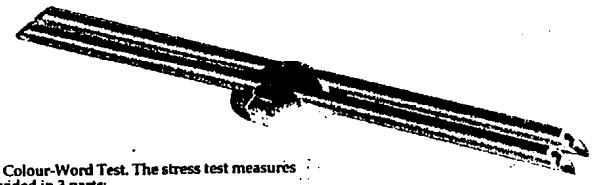
° Subjects surveyed in this study are 119 VDU workers of several French and Swiss Companies and Administrations, working at least two hours per day on computer : no other criteria as - age, sex, job responsability, profession, feelings of uneasiness or disconfort in front of the screen - has been used in the selection of the participants. Each of the 119 tested participants was his own control.

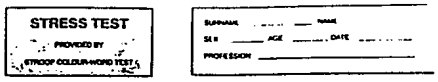


Electromagnetic field

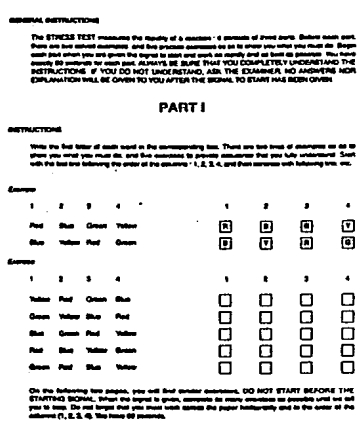


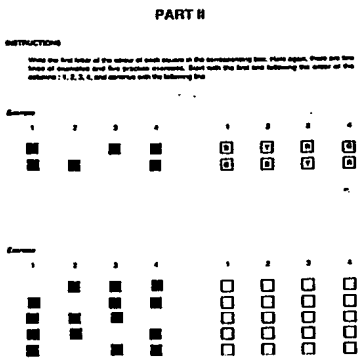
MAGNETIC EMISSION OF A TECNO AO ANTENNA
Measured by a SQUID magnetometer
(Superconducting Quantum Interference Device)
Main frequency : 12 Hertz
Induction : 100-150 femtoTesla

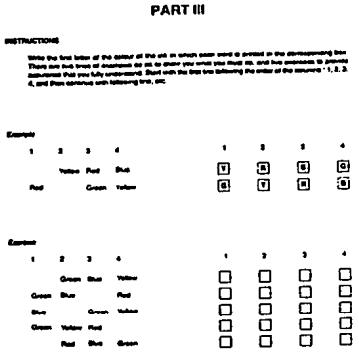




STRESS TEST provided by Stroop Colour-Word Test. The stress test measures the rapidity of a reaction and is divided in 3 parts:
Part I : Write the first letter of each word in the corresponding box.
Part II : Write the first letter of the colour of each square in the corresponding box.
Part III : Write the first letter of the colour of the ink in which each word is printed in the corresponding box.







° The psychometric test : STRESS TEST (Ed. Centre de Psychologie Appliquée, Paris) derived from Stroop Color-Word Test (Jensen A.R., Rohwer W.D. 1966) (Fig 2) was used to assess the degree of stress resistance against interfering distractions before and one month after installing the protective device.
The test consists of three exercises that estimates three variables: speed, vigilance and concentration.
The whole population (n=119) as well as two subgroups according to the degree of stress measured before the installation of the antenna were statistically analysed : the first subgroup (n=73) had a stress resistance lower than average, while within the second (n=46) the resistance was higher than average. The observed concentration score was compared to an ideal score proposed by the test authors, and based on a multiple regression estimation in which the independent variables were the scores obtained for speed and alertness (theoretical concentration = 0.16510* Speed + 0.48195* Alertness + 10.93454) Results are independent from learning effect (Jensen AR. 1965).

Finally, we intend to discuss if a progression of the clinical signs usually indicative of a stress state could be noted.
° A self-administered questionnaire, for evaluating development of complaints before and after a month, while electromagnetic protection was installed, was completed by 35 of the participants. The questionnaire contains the list of the physiological disorders usually felt after working on screen, i.e. :headaches , insomnia, irritability, nervosity, backpain, neckpain, redness of eyes, conjunctivitis, tearing ...etc.

A complementary part of the study is in progress, adding the analysis of the same tests realised after a month of fictitious protection with inactive antennas.
° A first exploratory test (without statistical analysis) in "double blind" condition was executed in Cochin Hospital with 7 placebos (fictitious non active antenna distributed at random)

RESULTS

In the whole population (n=119), the mean ratio between the observed and ideal concentration scores before the experiment was 0.948±0.144 (Mean±SD), with a 95% CI: 0.92 to 0.97. Ratios below 1 indicate that the person

is less resistant to stress, while ratios above 1 indicate a higher resistance to stress. After the experiment it rose to 1.07±0.12 with a 95% CI: 1.05 to 1.09 and the mean individual gain was 14.9%±19.3 (p=0.0001, Student t test for paired observations), 95% CI:12% to 18%. In the group less resistant to stress (n=73), the mean ratio between the observed and ideal concentration scores before the experiment was 0.86±0.11, with a 95% CI: 0.84 to 0.89. After the experiment it rose to 1.03±0.12, with a 95% CI:1.00 to 1.06 and the mean individual gain was 21.2% ±20.1 (p=0.0001, Student t test for paired observations), 95% CI:17% to 26%. In the group more resistant to stress (n=46), the mean ratio between the observed and ideal concentration scores before the experiment was 1.09±0.07, with a 95% CI: 1.06 to 1.11. After the experiment it rose to 1.14±0.07, with a 95% CI: 1.12 to 1.16 and the mean individual gain was 5.1%±8.5 (p=0.0001, Student t test for paired observations), 95% CI: 2.6% to 7.6%.

Table 3. Statistic results of stress resistance

Table 4. Mean change in psychometric test results

Table 5. Individual stress resistance

Among the 35 participants at the clinical questionnaire, 27 of them reported an improvement or disappearance of one or several of the following troubles, after a month with the electromagnetic protection device Tecno AO.

Table 6 **QUESTIONNAIRE RESULTS**

	Improvement	**Disappearance**
Individual 1		1 irritability
2		2 stress, general fatigue, anxiety, nervosity
3	no sign	3 no sign
4	anxiety, irritability,	4 stress, headaches stinging of eyes,blurred vision
5	redness of eyes	5
6	stinging of eyes, tearing	6
7	tearing, concentration,depression	7 redness of eyes, stinging of eyes, conjunctivitis, memory deficiency, irritability
8		8 headaches, redness of eyes, tearing
9	irritability	9
10	redness of eyes, tearing	10
11	headaches	11
12	no sign	12 no sign
13	headaches, fatigue of eyes, irritability	13
14	eyes irritation	14
15	acuteness of vision	15
16	headaches, fatigue, somnolence	16
17	ocular fatigue	17
18	no sign	18 no sign
19	headaches, concentration, insomnia, irritability	19
20		20 irritability
21		21 redness and stinging of eyes
22	general fatigue, irritability, weariness	22
23	concentration, nervosity, acuteness of vision	23 headaches, weariness

Among the medical secretaries of Cochin Hospital (Individual 24 to 35) 11 out of the 25 secretaries reported various disorders linked to VDU work : ophtalmological disorders (redness of eyes, stinging, tearing) musculoskeletal (neckpain, backpain), headaches and neuro-psychological (anxiety, irritability, sleep troubles). After a month of work in the presence of an active antenna, 6 persons reported a clear diminution or subsidence of the observed disorders.

DISCUSSION

For the 7 participants with fictitious non active antennas in Cochin Hospital, we observed a low placebo effect while a high result with active antennas. Therefore the placebo effect could be considered negligible, since the evolution of stress resistance and psychometric performances is not spread uniformly in the whole population:

the initially very stressed subgroup (A1) benefits more from VDU electromagnetic protection (in a ratio of 4 to 1 against the initially unstressed subgroup (A2). The results statistically analysed show a sizeable improvement of 21,2% (for A1) for the persons with a stress resistance at an initially very low or lower than the standard level (called "stressed"), while a minor improvement (only 5,1%) of the performances is registered after protection for the persons with a stress resistance level . higher than the standard (A2). Globally compared, the objective psychometric STRESS TEST results with the data of the subjective clinical questionnaire after protection are corroborated : (Stress test : 97 persons improved their results out of 119 tested, i.e. 81%. Clinical questionnaire: 27 respondents reduced their discomfort or disorders out of 35 questioned, i.e. 75%).
This could mean that the stress state initially observed in clinical medicine among the operators before protection is really related to the VDT radiation, an unique factor which is modified by the presence of Tecno AO magnetic oscillator, everything otherwise remaining equal.

PSYCHOMETRIC STUDY: CONCLUSION

Ergonomics seeks to limit those factors known to cause fatigue and chronic stress during computer work. It does so by prescribing brakes, adapting ambient light, air humidity; and recommending appropriate sitting positions and screen optical quality. Dr. P. Loiret (in an 8 year study on 3000 VDU workers) has shown that after a threshold of two hours per day of VDU work, there is an observeable increase in neuropsychological disorders, ocular-visual affections and headaches.
Using the magnetic oscillator Tecno AO, as a VDU electromagnetic protection device, affords the possibility of identifying the stress effect from VDU radiation.
In this psychometric study, the mean change in concentration scores in both subgroups was statistically significant (p=0.0001 Student t test), meaning that people less resistant to stress benefit more from VDU electromagnetic protection. The data showing decreases in psychometric performances, when compared to data after one month of VDU electromagnetic bioprotection with Tecno AO compensating emission, justify the growing concern for the stress-inducing factor in the electromagnetic VDU environment .
The results taken as a whole show a significant improvement in stress resistance in the overall study population equipped with the electromagnetic protection antenna : VDU radiation could be a cause of what we suggest calling "electromagnetic stress". The increase in resistance to stress and psychometric performance with Tecno AO technology brings the hope that a solution has been found to protect human health from VDU electromagnetic stress.

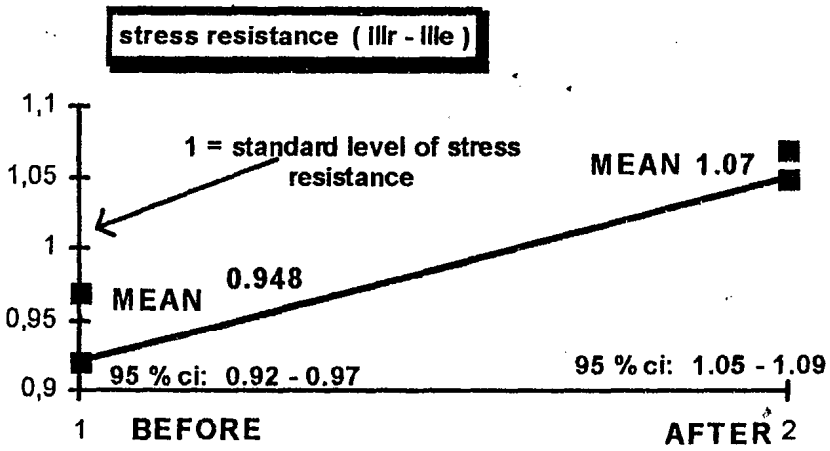
Fig 2. STRESS TEST

The STRESS TEST was provided by Stroop Colour-Word Test. This stress test measures the rapidity of a reaction and is divided in 3 parts:
Part I : Write the first letter of each word in the corresponding box.
Part II : Write the first letter of the colour of each square in the corresponding box.
Part III : Write the first letter of the colour of the ink in which each word is printed in the corresponding box.

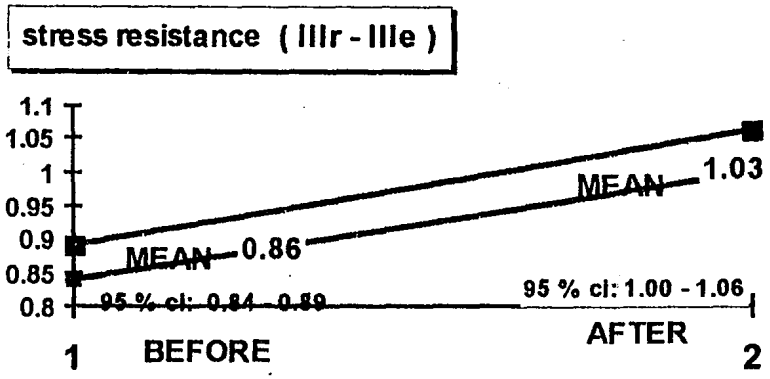
Table 3. STATISTIC RESULTS OF STRESS RESISTANCE
(4 weeks after installation of Tecno AO antenna on the computer work station)

	total group (n =119)	**subgroup A1** (n=73)	**subgroup A2** (n=46)
IMPROVEMENT IN: RESISTANCE TO STRESS	**+14,9%**	**+21,2%**	**+5,1%**

I - stress resistance after four weeks with Tecno AO : MEAN GAIN + 14.9 % (p=0.0001 Student t test for paired observations) - 119 studied cases.



I a - stress resistance of subgroup A1 (73/119 studied cases are initially below « TEST DE STRESS » standard)
MAIN GAIN = + 21.2 %



I b - stress resistance for subgroup A2 (46/119 cases studied are initially above « TEST DE STRESS » standard)
MAIN GAIN : + 5.1 %

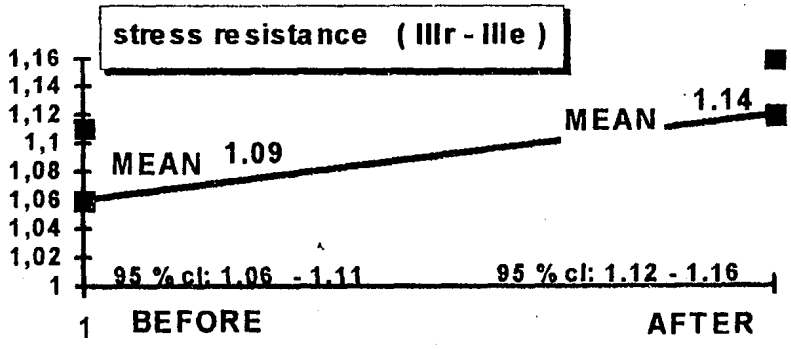
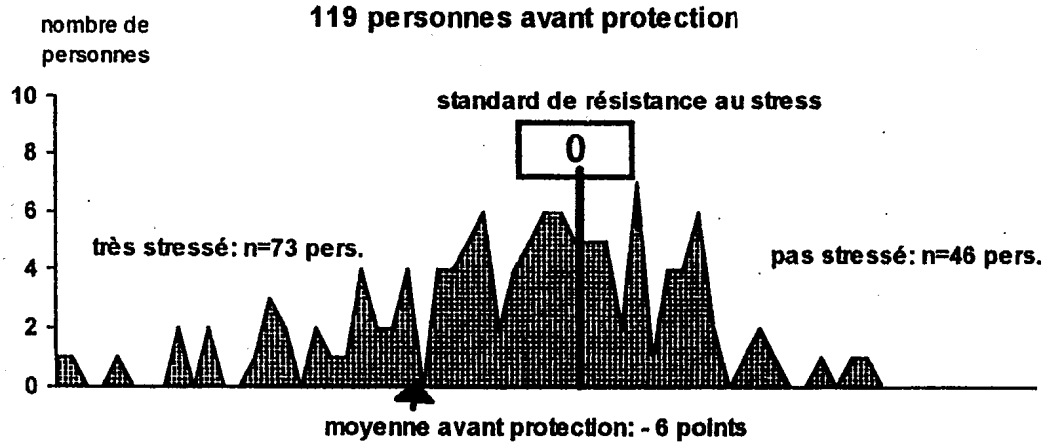
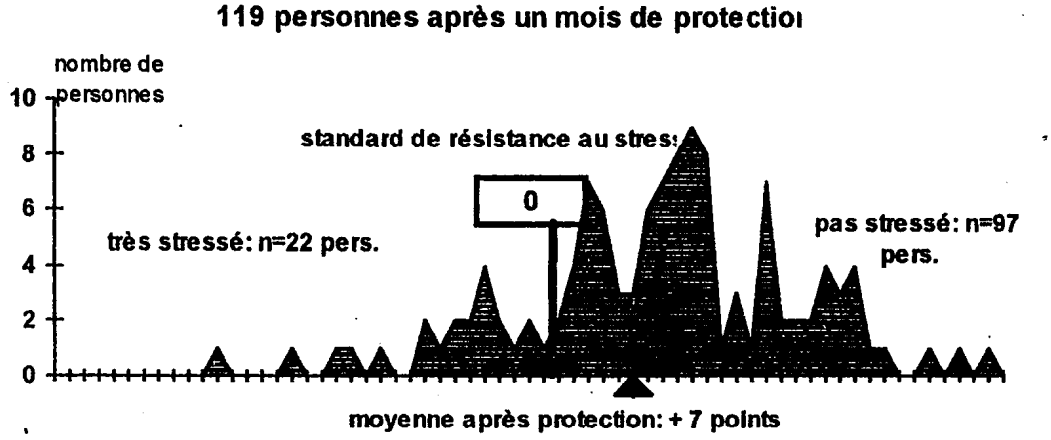


Table 4. MEAN CHANGE IN PSYCHOMETRIC TEST RESULTS
(4 weeks after installation of Tecno AO antenna on the computer work station)

	total group (n =119 individuals)	**subgroup A1** (n=73 individuals)	**subgroup A2** (n=46 individuals)
INCREASE IN:			
SPEED	+13%	+12%	+14%
ALERTNESS	+9%	+9%	+9%
CONCENTRATION	+23%	+30%	+14%

Table 5 . INDIVIDUAL STRESS RESISTANCE
(before and 4 weeks after installation of Tecno AO on the VDU)





ADDITIONAL TESTS ON HUMAN SUBJECTS
(Tecnosphere Research Centre, WWDU, 1994)

Previously, in order to evaluate the effects of VDU electromagnetic pollution and the possibility of effective protection with a compensating magnetic emission, we have used Tecno AO antenna in some others measurements and tests in human immunology (I.) and human neurology (II) (WWDU'94, Milano 1994)

ELECTROMAGNETIC STRESS IN THE VDU USERS AND CORRECTIVE RESULTS OBTAINED WITH ELF EMISSION AT ULTRA LOW INTENSITY.

I. G. Caron, Medical Analysis Laboratory, Monceau, France and Tecnosphere Research Centre, WWDU'94 - Work With Display Units International Congress, Milano, 1994)
Study of lymphocytes ratio (T. Helper / T. inducteur and more specifically the relationshipCD 5 /CD 20) on VDU users before and after 15 days with electromagnetic protection antenna.

II. J. Catier, Hospital Department Head, Clinic Neurophysiology Department,C.H.U. Avignon, France and Tecnosphere Research Centre, WWDU'94, Milano 1994)
Analysis using the electroencephalogram(EEG quantified) - analysis of the magnitude of alpha and beta waves and the effect of electromagnetic stress from a viewing screen on the latter;- analysis of the change in the "total power" of the brain activity with Tecno AO protection antenna

I. TEST IN HUMAN IMMUNOLOGY

G. Caron, *Caron Laboratory of Medical Analysis , Montceau, France*

INTRODUCTION

This study was conducted to evaluate VDU electromagnetic field effect on immunological regulation in the VDU users. Analysis of B-lymphocyte ratio and more specifically the relationship CD 5 /CD 20 . The latter relationship is an indicator of immunological regulation; a "normal" relationship hovers around 10%.
The assays were realised in twice: first time without electromagnetic protection and second time after 15 days with tecno ao electromagnetic protection : a difference between both analyses can be significant for a variation greater than or equal to 15% of the baseline figure; its prolonged increase above 20% indicates a risk for potential development of auto-immune diseases .

MATERIALS AND METHOD

Samples D=0 and D+15 examined for lymphocytes typification as follows: total lymphocytes CD4—CD4+CD45 RA—CD4+CD29—CD8+ —CD8+CD/1b- —CD8+CD11b+ —CD57—ratio CD5/CD20. Seven people working, on an average of 6 hours a day, in front of a computer screen (operating all day long). Five of them were tested twice in 15 days; one in 7 days(=5); control only at D=0. One of these individuals (=6) has been previously protected with a Tecno AO antenna for 3 months. Blood tests were carried out as follows: baseline test on Friday morning of D=O prior to installation of the Tecno AO protection for individuals =1=2=3=4=5 and at the contrary with Tecno AO electromagnetic protection for participant =6. Second blood test on Friday morning of D+14 with Tecno AO protection for individuals =1=2=3=4; of D+7 for participant =5; of D+14 for participant =6 but without protection that means after removal of Tecno AO for 14 days.

RESULTS

Participant=4 CD5/CD/20 =16,09% =>16,7% (not significant because his ration CD4/CD/8 was already significant of an associated pathology (virus,etc.)
Participant=5 CD5/CD20 = 10,2%=>10,5% i.e. no change in ratio probably because of an experimental shorter period (7days only).
Participant=1 CD5/CD20 = 9,68%=>5,74% i.e. a decrease of 68,3%,-
Participant=2 CD5/CD20 = 27,6%=>18,2% i.e. a decrease of 51,6%.-
Participant=3 CD5/CD20 = 16% =>9,3% i.e. a decrease of 72%; i.e. an improvement with Tecno AO electromagnetic protection.
For individual =6 (who was previously protected for over 3 months in the baseline test and unprotected for 14 days in the second test) the relationship CD5/CD20 = 10%=>11,5% i.e. an increase of 14,2%; i.e. a deterioration when protection is removed.

DISCUSSION

The improvement is quantified by the decrease in the ratio CD5/CD 20. This ratio is increasing with several auto-immunological process. The results of the analysis on the immunological potential represented by the relationship CD5 /CD20 are sufficiently significant to state that the corrective ELF emission could have an *"immuno-regulator"* action on those screen users protected in this way from "electromagnetic" biological stress: an increase in ratios CD/CD20 was observed when the electromagnetic protection was removed and a correlated decrease in ratio for VDU protected people.

II. TEST IN IIUMAN NEUROLOGY

J. Catier, *Clinical Neurophysiology Department, Teaching Hospitals Avignon, Faculty of Medicine, Functional Explorations, Rennes Teaching Hospitals, France*

INTRODUCTION

Measurements of effect of VDU non ionising radiation on brain activity and measurements of the corrective effect from a molecular magnetic oscillator-resonator emitting compensating ELF at ultra low intensity (tecno ao antenna) Differencial analysis using quantified electroencephalograms of VDU working individuals. Analysis of the magnitude of alpha and beta waves and the effect of electromagnetic stress from a viewing screen on the latter; analysis of the change in the "total power" of the brain activity with Tecno AO ELF emitter restoring through a resonance effect the alpha rhythm of the brain.

MATERIEL AND METHOD

Quantified electroencephalograms on medical office secretaries working several hours a day on a computer were performed in two stages : Baseline on Friday=D 0 control electroencephalograms after several hours of computer work without electromagnetic protection; the following Monday =D+ 3 installation of the Tecno AO protection on the secretaries'computer. Second series of electroencephalograms on Friday=D +14 after several hours of computer work protected with Tecno AO since Day D+3

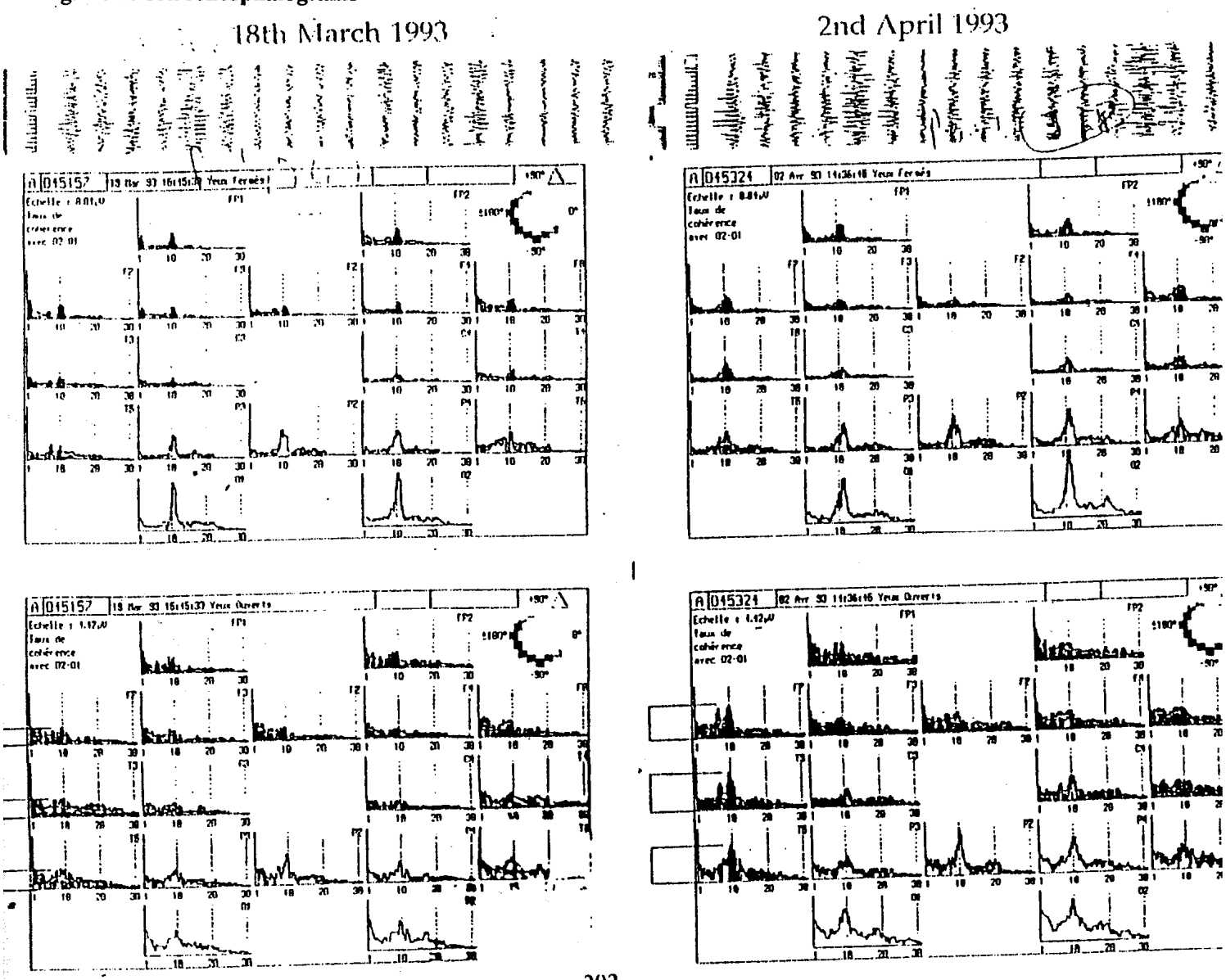
RESULTS

A marked increase in "total power" was observed for the closed eye, open eye and especially the SLI at 20 hertz sequences, on the total band of 0.5-31.5 hertz, and on the alpha (7.5 and 13.5 hertz) and beta (13.5-31.5 hertz) bands. Overall, it is a two fold increase ; in terms of the consistency levels for the posterior electrodes, a substantial improvement at the end of the tests for the same selected frequency bands primarily for the closed eye sequences and especially the SLI one.

Compared total power

With no protection on the computer :	alpha 123m V^2	beta 19,9m V^2	S.L.I.20Hz	16.5mV2
After 14 days with Tecno AO:	calpha 217 m V^2	beta 53,4 m V^2	S.L.I.20Hz	20,9m V^2

Fig. 7 : Electroencephalograms



DISCUSSION

The insignificant magnitudes measured at D=0, for the individuals tested prior to protection are the sign of chronic stress . The highly significant improvement of the EEG graphs after 14 days with the protective emitter demonstrate that the stress was of electromagnetic nature, therefore by emitting compensating ELF at ultra low intensity through a resonance effect, Tecno A.O. allow to eliminate this state of stress, objectified particularly by Alpha x 2 magnitude, Beta x 3 magnitude and an improvement of the consistency level. The differential analysis shows VDU disturbing stressing effect on the brain. (Fig. 7 : Electroencephalograms)

CONCLUSION

The results of comparative improvement -after 3 weeks of use with the Tecno AO antenna- in those previous tests in human immunology and human neurology, correlate with the results obtained in the present psychometric study and confirm the protective effect against stress from VDU electromagnetic fields.

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