BIOFEEDBACK MEASURES IN EMDR TREATMENT

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We compared the pre and post therapeutic treatment data using standard EMDR, using a tool such as biofeedback, capable of measuring certain physiological parameters in objective way. The goal was to check variations in the physiological indices and subjective evaluations of well being and discomfort in the subjects. Some psychotherapists will select subjects using an initial telephone screening followed by a battery of suitable tests. Using such tools, subjects affected by PTSD without comorbidity will be chosen. Independent assessors will evaluate them again after six weeks (blind design). After this assessment, subjective data will be collected using the SUD scale and objective data will be collected using the SPR, Thermo, Heart Rate, EMG of the biofeedback channels. After exposure the subjects will be randomly assigned to an experimental group, they will be going to meet in six sessions using the EMDR standard protocol and carried out by therapists recognised by the association EMDR Italy; the other half of the sample will represent the control group in a waiting list. Once more, all the subjects will be exposed to the trauma, this time listening to the recording of their description of the traumatic event. The SUD and biofeedback values will be then measured again. The comparison of the data of the SUD scale with the data of the biofeedback channels, in particular the SPR channel, plus the evaluation of the group of independent clinicians using the above-mentioned tests, will provide the co-ordinates for an evaluation (both subjective and physiological) of the clinical results of the EMDR therapy.
Key-words: *EMDR, SPR, Biofeedback-training, PTSD.*

Introduction

Most studies today are carried out following established guidelines whose purpose is to obtain accurate evidence based on scientific data. In fact, in spite of retaining its peculiarity, Psychology can now be considered a rigorous science like any other, in so far that it studies and explains human behaviour according to rule of evidence and principles.

This switch to a sound scientific methodology has produced vast improvements in many areas of psychological research and application. This was aided by the exceptional developments in informatics and statistics in general. This is marked contrast with EMDR method, which was born on the basis of the serendipity principle.

We are making the above observations the starting point of the work we propose.

We would like to begin by acknowledging our debt to Prof. Anchisi's and his co-workers' earlier studies which laid the basis for more rigorous and accurate studies on the subject, and whose pattern we shall follow.

GROUPS	Arrange	Phase 1: TEST A	Phase 2: TEST B	Phase 3: TREATMENT	Phase 4: TEST A1	Phase 5: TEST B1
Experimental Group A	Random	Test	Imagery Exposure and biofeedback measures	6 EMDR	Test	Imagery Exposure and biofeedback measures
Control Group B	Random	Test	Imagery Exposure and biofeedback measures	Waiting list (6 week)	Test	Imagery Exposure and biofeedback measures

TAB. 1

We selected patients who were then divided at random into two groups (Group A and Group B), then we organised our experimental pathway into the following five steps (tab. 1):

1. Pre-treatment assessment with specific test
2. Pre-treatment assessment with biofeedback methodology
3. EMDR treatment for Group A and waiting list for Group B
4. Post-treatment assessment with specific test
5. Post-treatment assessment with biofeedback methodology.

By adopting both psychophysiological measures and auto-subjective evaluations, we were able to detect and follow up any changes, starting from the initial difficulties experienced by the patients, to the final results we achieved.

Our experimental plan was aimed at assessing the reliability of the EMDR method in adult patients with Post Traumatic Stress Disorder (PTSD for DSM-IV, Criteria A1 in particular), or with memories associated with the trauma.

To obtain useful information we considered the outfit method, without taking into account individual variables, such as eye movements, or functioning hypothesis (or how the method works).

The question we sought to answer was: is EMDR effective?

We repeat we were interested only in the above method's effectiveness, and not in how it functions.

Method

Participants: This study is the first to be carried out using Italian patients, all of whom replied to our on-line advertisement. We screened each candidate by telephone and selected those whom we considered more suited to our purpose.

Procedures: We used 3 evaluative tools for each of our subjects pre- and post-treatment. The tests were carried out by independent investigators (double-blind check). These were: SCID-I, Beck Depression Inventory, Psychophisiological assessment, STAY-Y, Impact of Event Scale-Revised [phase 1]. A self administered rating scale with a SUD score, and the biofeedback were used by the evaluators, while access to the trauma itself had been made possible by encouraging the patient to visualize and therefore to relive the trauma (imagery exposure to the traumatic event) [phase 2].

Without re-access it is impossible to work on traumatic memories, and so there can be no improvement in the patient. And it goes without saying that a skilful therapist will always make sure that this re-exposure to the trauma takes place gradually to avoid traumatising the patient again.

In this case, the biofeedback method of assessment was aimed at fulfilling a precise need: to achieve a sensitive, objective and accurate method of measuring and collecting data. It was not intended to be used for comparing relaxation techniques with EMDR method, nor was it designed to produce a stress profile, nor for delineating a typical profile of PTSD. This is because of the high incidence of variability between individuals. We found biofeedback more useful as an indicator of the distress/well-being status of the patients during the time when the investigator had "access", and, consequently, when the probability of succeeding in re-exposing the patient to the trauma was at its highest.

As an electronic instrument, it promises to become an invaluable aid to the diagnosis of many other clinical cases, if used correctly. In fact, it has already been successfully used in dentistry for bruxism therapy, in neuromuscular rehabilitation, in many kinds of stress disorders, tics and stutter. It appears, therefore, that data collected with the biofeedback method can be considered reliable, and free from any evaluative bias on the part of the investigators.

Our next task was to arrange people randomly into two groups mentioned at the beginning: the experimental group A worked for six weeks with the EMDR standard method for PTSD, while group B did nothing, they just waited for a similar amount of time [phase 3].

At the end of this period, both groups were evaluated by subjecting them to the same test and instruments [phases 4 and 5]. Thanks to biofeedback, data could be statistically analysed rapidly; thus giving studies such as our scientific validity. We utilised the integral calculus of the value of the curves obtained from our biofeedback software, and thanks to this instrument we now have data always available on our computer (see fig. 1 and 2).

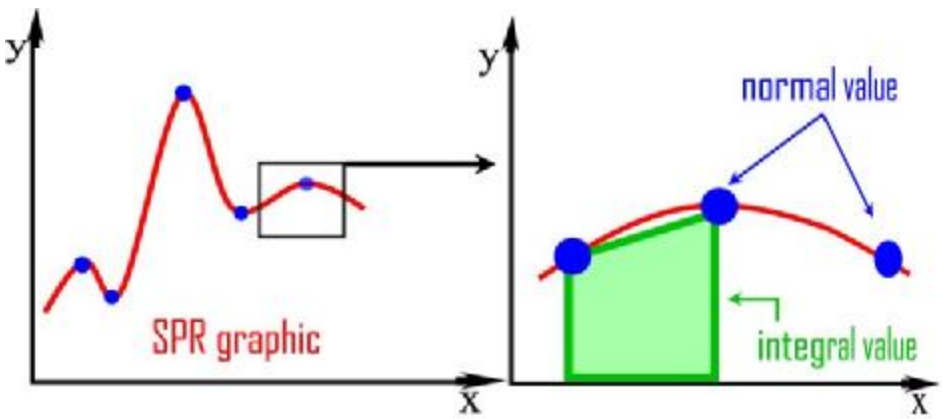

FIG. 1

We believed that the analysis of the curves through the calculation of the integrals has the great advantage of permitting a uniform evaluation and comparison of the data obtained from different graphics, initially expressed in differing measure units.

A preliminary analysis (Bartlett test) shows that it is necessary to use non-parametric test, because the variance is not homoschedastic. We wanted to obtain the

maximum amount of information from the various data we were gathering. The biofeedback system acquired 2 data per second, from each channel.

FIG. 2

Aim of research

Our objectives now are the following:

- Check the correlations between all channels, and we will probably see similar changes in similar directions. But it is possible that we will observe the mis-syncrony phenomenon;
- Check the discrepancy between subjective and psychophysiological data. This is important if one is to learn more about the relationship between the perception of disease, emotion, and body sensation;
- Check the effectiveness of EMDR through a comparison between the two phases of trauma exposure pre- and post-treatment. The starting hypothesis was: if EMDR works, the patients should feel better, and their anxiety level will have decreased, while will be registered by biofeedback. We can observe it thanks to biofeedback instruments;
- Each recording phase is composed of:
  - Starting baseline (4 minutes);
  - Imagery exposure (2 min);
  - Final baseline (4 min).

At the end, following this we can compare the results of these three phases.

Biofeedback and SPR

Correct methodological rules used in conjunction with the biofeedback technique, in addition to statistical analysis, help to highlight those characteristic signs which are fundamental for a correct understanding of the results of EMDR therapy.

This is the reason why we chose the biofeedback method as an evaluation instrument of those psychophysiological variables, which provide an indication of the emotional status of the subject. Regarding this matter, we make a reference to a past study which compared PTSD symptoms with a possible alterations of sympathetic system and catecholaminergic activity (release of adrenaline and nor-adrenaline). It was pointed out that the physiological reaction that appeared during the post-traumatic emotional experience mirrored exactly the one experienced at the time of the original trauma. So, if the trauma has not been elaborated in an adaptive way, it is possible, even after a long time, to measure the level of distress and anxiety created in the subject through psychophysiological variables.

The most important variables in the investigation of the PTSD are considered to be cardiac frequency, blood pressure, muscular tension and cutaneous conductance. It is possible to investigate all these channels through biofeedback, but we would like to inform the reader that there is no direct, or simple, or linear consistency, between physiological and psychological systems. Furthermore, we know from available literature on the subject, that there is no clear boundary between sympathic and parasympathetic activities, and this because the two systems are independent and complementary.

What was of interest to us was to be able to measure emotion in two dimension: the valency (a response is never neutral, it always has a sign) and, of course, the arousal (activation level). During the time of exposure to images of the traumatic event, arousal is the main variable registered by the biofeedback.

On the neuro-anatomical side, the superior nervous centres activated by the reaction to the stressful event (or emotional activity) are the sub-cortical areas, especially the hypothalamus and the limbic systems. The stimulation of these nervous structures activates the peripheral response which can be registered. At a cognitive level however, an anxiety state can be observed.

On the other hand, the anterior hypothalamic area provokes a trophotropic response and a deep relaxation as a consequence. The biofeedback functionality is mainly based on these principles. The SPR channel, in particular, is used by evaluators, and it consists of a measure of electrodermic potential considered an indication of the cognitive activation in the subject. Another way of measuring this index is based on cutaneous conductance using a psychogalvanometer. SPR channel is more precise than that old method. With SPR there is not necessity for a real sweating episode to occur in order to have the passage of exodermic current, which would cause a prolongation of time registration with loss of sensitivity.

Methods of recording	**Endosomatic**	**Exosomatic**			
Applied current		**Direct current:**		**Alternated current:**	
Units	Skin potential	Skin resistance	Skin conductance	Skin impedance	Skin admittance
In general	***SP***	***SR***	***SC***	***SZ***	***SY***
Tonic (level)	***SPL***	***SRL***	***SCL***	***SZL***	***SYL***
Phasic (response)	***SPR***	***SRR***	***SCR***	***SZR***	***SYR***

TAB. 2

SPR is a direct, instantaneous measure, of activity of the endodermic glands. Its principle is based on the excitation potential of sweat glands, which allows us to distinguish between positive and negative emotions. SPR stands for what we measure, that is, Skin Potential Response to an acute stimulus. See tab. 2 for measures of electrodermical activity (Boucsein, 1992).

Description of the application method (see fig. 3): 3 sensors are positioned on the skin. The first two are placed in areas where the concentration of sweat glands varies, and this in order to create a differential potential. The third sensor is positioned as earth at equal distance from the other two. The above graphic shows a sinusoidal wave with both positive and negative spikes, characteristic of each subject to the point that they can be considered the equivalent of "fingerprint" (Furedy 1993).

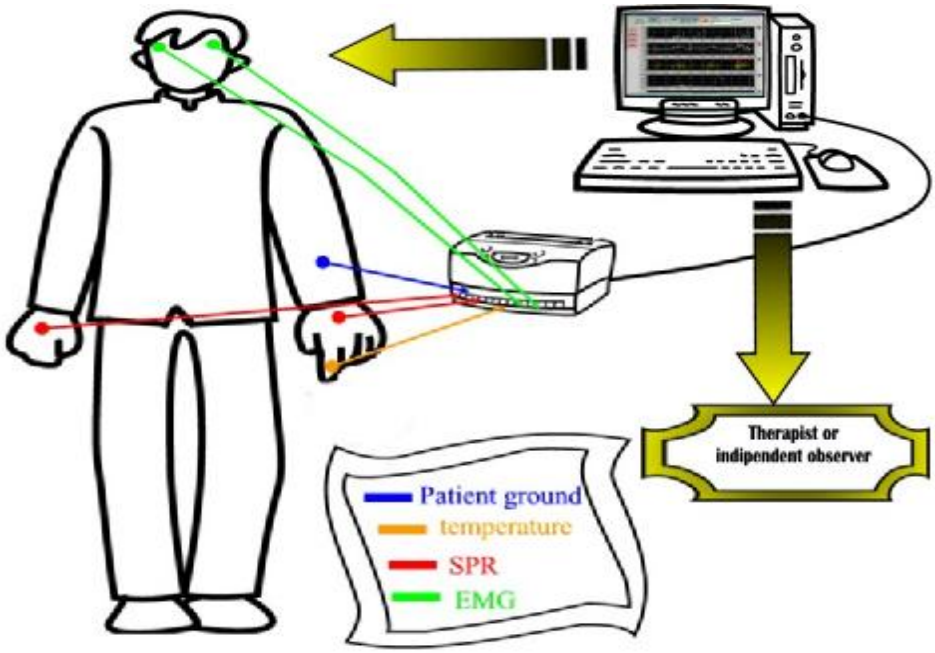

FIG. 3

SPR channel measures the vigilance status of the subject. He will experience different activation levels according to situational difference. What is of real importance in the individual is his cognitive evaluation of the stressful event, and how it is elaborated and experienced, not the real characteristics of the event itself, or how dangerous, or frightening, or life-threatening it actually was.

The sweating activity should be present only in he regions of the axillas, palm of the hands and sole of the feet, these being considered the elective areas for this type of activity from both the morphologic and physiologic point of view, if we exclude particular conditions of high external temperature.

It seems therefore, that there is a degree of consistency between, for instance, hand sweating and psychic activity. In fact, we came to the conclusion that electrodermic activity is an indicator of general arousal levels, particularly when the arousal is linked to stressful conditions. It seems clear to us therefore, that a sweating episode is present when a cognitive elaboration is activated, though we recognise that sweating may also be associated with other reflected activities, and this, for the reason that sweat gland innervations is located in the marrow.

There are almost 3 million sweat glands in the human body, though not every one is active. Skin and gland activity is quite complex, as showed. The skin, for instance, possesses a number of vegetative efferential fibres, sympathetic and parasympathetic. They are responsible for the innervations of the secretory trait of the sweat glands, the muscles of piloerection and vasoconstriction phenomenon. These mechanisms explain why sweating, becoming pale and piloerection are the response to a threatening stimulus. All fibres departing from the grey substance of marrow. Sympathetic spinal fibres run across the anterolateral part of the marrow, close to the pyramidal tract. If post-gangliar sympathetic fibres use adrenaline and noradrenaline as neurotransmitters, the transmission within the glands will be of cholinergic kind (Ach). Also adrenergic fibres innervate the glands, and, in fact, we want to underline the role of adrenaline in the apocrine glands secretion.

The Autonomic sympathetic nervous system has its main origins in the hypothalamus: sympathetic stimulation (ergothropic) of the para-ventricular and posterior nuclei triggers off the activation of sweat glands, piloerector muscles and vasoconstriction.

Another sympathetic lemniscus, principally originating in the hypothalamus, runs across the reticular substance and then across the marrow, probably ipsilaterally.

Many thermoregulatory functions of the hypothalamus are under the control of the limbic system, especially of the amygdala (also involved in mnesic circuits), and of the hippocampus.

There are other nervous nuclei in the hypothalamus function: the thalamus, the 6th Brodman Area of the temporal lobe, basal ganglia (striatum and pallidus).

We would like to point out the important role of the mnesic circuits, which in essence concern the amygdala as anatomic structure. Recent theories about memory (Van der Kolk, et al. 1997) start from the hypothesis that if traumatic experiences are stored without having been enough elaborated, or not appropriately, then the traumas return to the conscious level accompanied by the original distress, emotions and negative physical sensations. And this is what we intend to measures.

It is possible that another datum will be evidenced by comparing of psychophysiological data, subjective evaluation, and different response channels, as mentioned. It is named the mis-synchrony phenomenon, already discovered by Hodgson and Rachman in 1974. In fact, in the treatment of agoraphobia and other anxiety disorders, behavioural aspects improved first, while the cognitive aspect improved last. It is therefore very important to check each channel at every level: cognitive-verbal, motor-behavioural, psycho-physiological.

FIG. 4

Conclusion

Finally, we would like to affirm the importance of the biofeedback role in supplying information about the rate and intensity of the anxiety experienced by the patient. It also proves an invaluable instrument in greatly enhancing the quality and reliability of our experiment. We also believe that it will prove extremely useful in helping to generate new ideas for further developments. For example, one key-question concerns the therapeutic use of biofeedback, for example during EMDR treatment.

We are presently awaiting the results of our study, and it is expected that, at the end of the EMDR treatment, the psychophysiological data of group A will show a lower level of anxiety than at the beginning, and lower than that of group B. We will, however, provide the readers with the results of follow-up test.

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