

CHILD TRAUMA, ATTACHMENT AND BIOFEEDBACK MITIGATION

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Abstract: The aim of this study is to investigate the correlation between the quality of attachment in early infancy and the effects of child trauma, as well as to introduce some innovative therapeutic approaches.

For this reason, a group of 10 children manifesting post-traumatic stress disorder (PTSD), diagnosed by ICD-10, was selected. The mean age of the patients was 9 ± 3.05 years, from both sexes (girls 3, boys 7).

Mothers and children were examined by a battery of psychometric instruments Minnesota Multiphasic Personality Inventory (MMPI), Child Behaviour Checklist (CBCL), Eysenck Personality Questionnaire (EPQ), and State Anxiety Inventory (STAI). In addition to the classical psychotherapeutic methods (supportive, behaviour and play therapy), the multimodal computerised biofeedback technique was introduced for both assessment and therapy.

The results for the children showed a high level of anxiety and stress, somatisation and behavioural problems (aggressivity, impulsivity, non-obedience, and nightmares), complemented by hypersensitive and depressive mothers and misattachment in the early period of infancy.

Consequently, the explanation of the early predisposition to PTSD was related to be the non-developed Right Orbitofrontal Cortex-ROFC. The latter was related to insecure attachment confirmed in all the children examined.

The therapeutic results obtained with biofeedback techniques are very encouraging.

Key words: attachment, biofeedback, child trauma, post-traumatic stress disorder.

1. Introduction

The condition of stress has two main components: physiological (direct material or bodily challenge) and psychological (related to the perception of circumstances). Both components can be examined in three ways, focussing on the stressor, the response and the transaction between them. [1].

In clinical practice, the measuring of the stress could be performed through physiological arousal (Electrocardiogram – EKG, Electrodermal response-EDR, arterial tension – TA), or by psychometric instruments like Life Events or Daily Hassles. Reactions to stress vary from one person to other, and from time to time. The variations depend on psychological and social factors, which modify the impact of stressors on the individual. [2, 3, 4]

Psychophysiological disorders result from the interplay of psychological and physiological factors. There are many skills and strategies for coping with stress. Emotional discharge (expressing feelings) and cognitive redefinition (as a defence mechanism) are the most frequent used strategies for emotion focusing coping in adult people. However, in childhood, coping with stress is still not enough structured. [5]

Generally, stress management related to child trauma comprises any intervention for reducing stress reaction. For this reason, medication (benzodiazepines, beta-blockers, etc.) or behavioural and cognitive methods like: relaxation procedures, systematic desensitisation, massage and hypnosis are used. [6, 7, 8]

In this paper the main question to be answered is the relationship between attachment and reactions to stress in children. In addition, the efficiency of multimodal biofeedback for child trauma mitigation is explored, an approach applied here for the first time to children with PTSD in the Balkan region.

2. Basic mechanisms

2.1. Attachment

Attachment is the term used by John Bowlby [9] to describe the affective bond that develops between an infant and a primary caregiver. Bowlby described the infant as biologically predisposed to use the caregiver as a haven of safety or a secure base while exploring the environment. The caregiver's response to such bids helps shape the attachment relationship into a pattern of interaction that develops over the first year of life. The history of this developing relationship between infant and caregiver allows the infant to begin to anticipate the caregiver's response to bids for comfort. [10,11, 12, 13]

Interaction between mothers and babies plays an important role in the formation of attachment and in determining maternal response to the infant's signals. In this context, there is research evidence that breast-feeding mothers differ from bottle-feeders in satisfaction with the experience, in acceptance of the maternal model and emotional investment in the infant. [14, 15]

Secure attachment arises out of responsive and sensitive parenting and is contrasted to adult neurosis. By studying a sample of unweaned babies and their mothers, Ainsworth *et al.* [16] discovered three different levels of attachment: securely attached, insecurely attached (avoidant, ambivalent and disorganised) and non-attached children.

In ICD-10 [17] and DMS-IV [18] two varieties of attachment disorders are recognised: a) non-attachment with emotional withdrawal, typically associated with abuse and b) non-attachment with indiscriminate sociability, most usually observed when children have been exposed to repeated changes of caregivers.

2.2. PTSD and ROFC

Post Traumatic Stress Disorder (PTSD) is classified under anxiety disorders in both ICD-10 and DMS-IV and its onset may occur in individuals across the lifespan. There are no specific criteria for PTSD with an onset in childhood. In DMS-IV it is noted that children's responses to severe trauma may be more disorganised than in an adult and can involve agitated behaviour. Their response may include intensive fear, helplessness or horror. The event must be persistently remembered and 'relived' with concomitant distress, particularly when current circumstances are associated with the original event.

Clinical characteristics of PTSD are: intrusive and distressing recollections of the event seen by them in play, nightmares, re-enacting the event behaviourally, avoidance of stimuli associated with the trauma, increased arousal, visual imagery (flashbacks), and 'especially in adolescents, increasing risk of irritable moods and sleep deprivation. It is noticed that girls are more susceptible to PTSD than boys. There are no precise epidemiological data about PTSD. In war conditions the incidence is about 11.5%, while after accidents the incidence is higher, approaching 30% [6].

The right orbitofrontal cortex (ROFC) has been pointed out as crucial in the regulation of emotions and the autonomous nervous system (ANS). Consequently, infants with attachment problems have a problematic ROFC and are more predisposed to PTSD. ROFC is not on line at birth. It develops only through interaction with another self, another brain. [19]

The engagement and attunement of the mother stimulate positive emotions and develop the ventral tegmental dopaminergic pathways of excitatory

arousal. Thousands of positive interactions are needed to develop this system in the first year of the life. A poorly attuned mother does not allow infant self-regulation of the sympathetic system. In the second year parasympathetic inhibiting circuits become internalised. Infants experience a shame-based inhibition of unbounded excitation. These negative experiences develop the lateral tegmental parasympathetic noradrenergic system. The caregiver must avoid toxic shame, severe humiliation, or aggressive interaction as these produce excessive anxiety and infantile rage responses. Flexible switching between these two systems (Sy and PaSy) allows successful methods for rudimentary coping with stress. [20]

Within the attachment relationship the mother is shaping the infant's coping systems (brain-body reaction to the stress). The model of Bowlby, enriched by the neurobiological findings of Shore shows how early social emotional interactions within the attachment relationship impact the experience-dependent maturation of the baby's brain. This is partly determined by genetic factors (encoded in the temperament) and partly determined by early socioaffective experience (nature of caregiver). It is obvious that the brain growth spurts continue from the end of the last trimester of pregnancy through the first two years of life. Both DNA and RNA levels in the cortex increase over the first year, and the maturation of the brain is experience-dependent. Thus, an integrative, interdisciplinary approach to the development of the child is needed. [21, 22]

3. Methodology

We selected a group of 10 children manifesting PTSD diagnosed by ICD-10 criteria age 9 ± 3.05 years, (girls 3, boys 7). In our study boys were predominant, as opposed to other authors who noticed that girls are more susceptible to PTSD.

Through anamnesis, symptomatology and psychometric evaluation we tried to reveal and explore the relationship between the early child experience (attachment bonding) and the degree of stress reaction.

Mothers are checked by Minnesota Multiphasic Personality Inventory (MMPI) [23] and Child Behaviour Checklist (CBCL) [24], while children are examined by Eysenck Personality Inventory (EPQ) [25] and State Anxiety Inventory (STAI) [26].

In addition to the classical treatment of PTSD (behaviour-cognitive and play therapy) [27] we introduced multimodal biofeedback application (Electrodermal and Neurofeedback) for both assessment and therapy [28, 29]. Biofeedback method is increasingly used worldwide; still, to our knowledge, our team is the only one applying it in south-east Europe.

Feedback is defined as a method of controlling the system by reinserting the results of its past performance, while biofeedback (BF) is the method of learning self-control by back-reporting biological signals. BF has several modalities depending on the type of bio signals: electrodermal response (EDR), electromyography (EMG), electroencephalography (EEG), BVP (blood volume pulse), RWF (respiratory waveform), etc. Figure 1 shows the biofeedback process schematically.

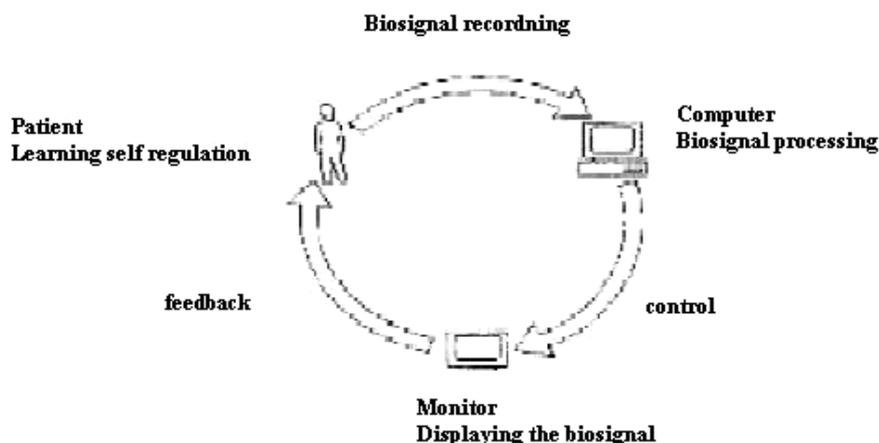


Figure 1. Schematic presentation of the biofeedback method

4. Results and discussion

4.1. Anamnesis

As stressful events provoking PTSD were identified: in three cases – the death of family members (parent or grandparent), in three other cases – a car accident, and in four last cases – the war conditions (explosion of a bomb near the school).

The interview with mothers in all cases showed different types of insecure attachment. In two cases the mother was still a psychiatric patient (severe depression), and in others some specific situations in the family were assumed to be the reason for insecure attachment. For illustration I will present three cases typical of the insecure attachment and clinical symptomatology relation. Generally, the anamnesis showed the imbalance between the pronounced clinical symptomatology and the stressors.

In what follows, we present three typical cases illustrating the attachment-symptomatology correlation.

Case 1. (loss of grandfather): *The nine-year old boy D. had been brought at midnight to the hospital by emergency ambulance, having had an attack of aggression directed against his mother and grandmother. He expressed uncontrolled and destructive rage for 3–4 hours. At the hospital, he was immediately calmed with medications. Anamnesis showed D. as the only child in an incomplete family. His father had abandoned his mother when she was still pregnant. Being unemployed, the mother left D. in an orphanage, but, after a few months, she took her baby back. No early attachment bond with the mother was created. The boy grew up in a village with his grand parents. The only person with whom the child made a close interrelationship was the grandfather. The boy has grown into a strong and healthy child, and started the school on time. The grandfather died unexpectedly when D. was 9 years old. The mother tried to conceal this, but few days later, the boy understood that his grandfather had died. D. became disobedient, impulsive and failed at school. The attack of aggression started at a moment of some disagreement with his mother. The aggression seemed to be a punishment for the loss of the unique person to whom D. had been attached.*

Case 2. (car accident): *Two siblings (a girl of 9, and a boy of 12 years) manifested PTSD one week after a car accident. The accident wasn't serious, only a small scratch on the tabletop was made. Children had flashbacks, arousal, nightmares and a fear of being alone. They live in Tetovo, where serious ethnic tensions are still present. The mother was a psychiatric patient for five years and the children had no secure attachment to her. They were Albanians living in a big, patriarchal family. Changing caregivers, they had insecure ambivalent attachments that resulted in the manifestation of PTSD after a relatively small car accident.*

Case 3. (bomb explosion): *A four-year-old girl was brought to hospital because of headache, stomachache, disobedience and fear of sleeping alone. This happened shortly after the explosion of a bomb. The mother, employed as waitress, could not be bonded to her child because of the job, so the caregiver had changed many times (grandmother, father, grandfather, and neighbours). The stress provoked signs of somatisation. As is known, somatisation is present in 75% of PTSD in small children. The same stress (explosion of the bomb) provoked PTSD in only four children (from a total of 560 in the same school) all with insecure attachment.*

As is clear, all children manifested PTSD after a relatively small stress because of insecure attachment.

4.2. Psychometrics

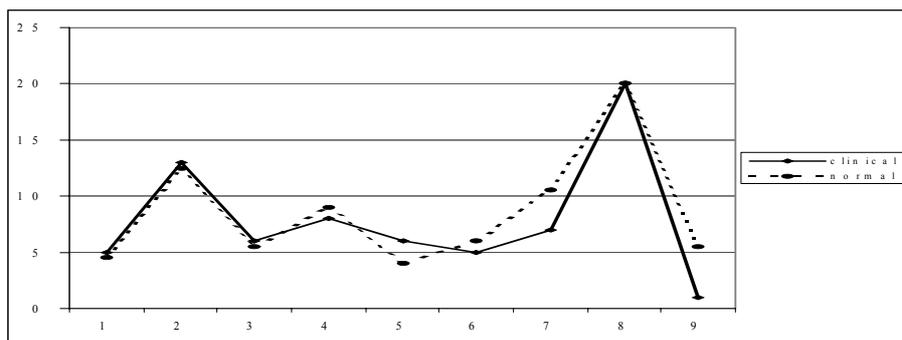
Results obtained for EPQ confirmed neurotic tendencies, introversion, psychopathologic traits and tendencies to social liability (Table I). The control group consisted of 35 healthy schoolchildren, both sexes.

Table I

Group's results from Eysenck Personality Questionnaire (EPQ)

Neuroticism (N)	Extroversion (E)	Social liability (L)	Psychopathology (P)
PTSD 17.4 (± 3.5)	9 (± 2.3)	8.5 (± 5.3)	12.5 (± 4.3)
Control 13 (±3.7)	16 (±2.7)	14 (±4.03)	6 (±3.03)
<i>t</i> test 3.55 (p<0.01)	<i>t</i> test 7.07 (p< 0.01)	<i>t</i> test 2.93 (p<0.05)	<i>t</i> test 7.17 (p< 0.01)

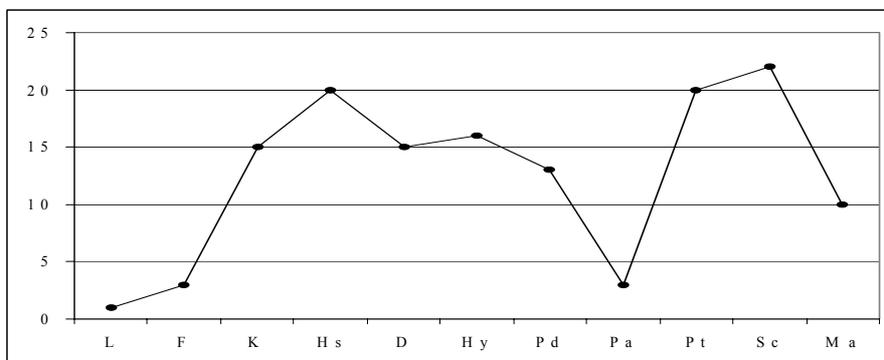
Results for CBCL – boys, illustrating behaviour problems, are presented in Figure 2. Generally, high internalising scores are obtained for all children, while externalising scores appeared to be high only in boys, with aggressivity particularly accentuated.



1. anxious; 2. depressed; 3. uncommunicative; 4. obsessive-compulsive; 5. somatization; 6. social withdrawal; 7. hyperactive; 8. aggressive; 9. delinquent

Fig. 2. Results obtained for CBCL-boys

Figure 3 presents results obtained from MMPI of mothers. High Hs scale confirms narcissism and hypochondriasis; while scores for other scales are related to expressed immaturity, impulsivity, anxiety and moderate depression.



L, F, K-validity scales, Hs-hypochondriasis; D-depression; Hy-hysteria; Pd-psycho-pathic deviate; Pa-paranoia; Pt-psychasthenia; Sc-schizophrenia; Ma-hypomania

Fig 3. Results obtained for mother's MMPI

The evaluation of children with State Anxiety Inventory (STAI) showed mean values for anxiety level 39.5 (from max 45) for the whole group, which is related to very high actual anxiety.

4.3. Biofeedback

The EDR-biofeedback was used for assessment of the stress level, which is related to skin electric resistance. Reducing the stress-level by relaxation, the skin resistance increases. On the other hand, the recalling of a stressful event provokes the abatement of the curve, i.e. increasing stress-level, resistance decreases (Fig.4).

R(K Ω)

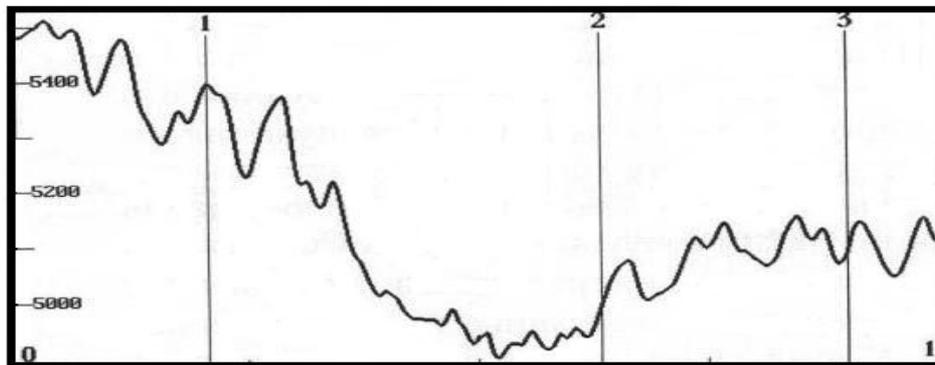
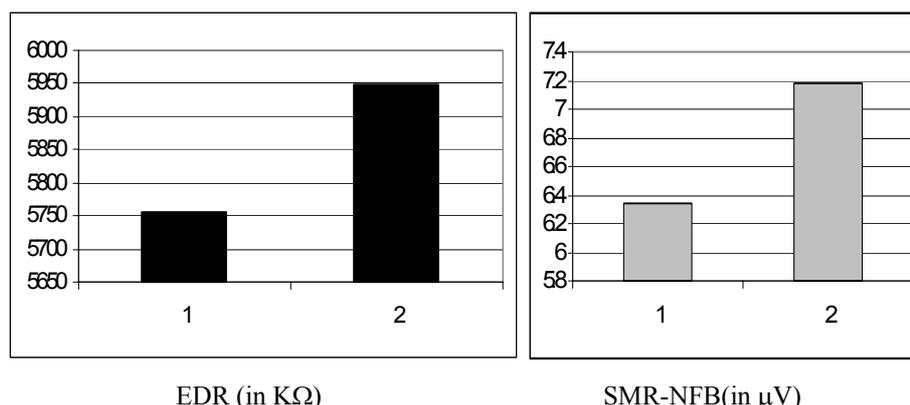


Figure 4. Short-term abatement of electrodermal resistance (in K Ω) provoked by recalling a stressful event

In the Figure 5 the summarized results of the change of biofeedback indicators for PTSD are presented. On the left, EDR for the whole group from the first and the last session of EDR BF (in K Ω) is presented. The increase of the EDR resistance shows the relaxation after 20 sessions training. On the right, the change in SMR-NFB (in μ V) followed by lower arousal is presented.

In addition to EDR biofeedback, we used neurofeedback (EEG biofeedback) for stress reducing in PTSD children. PTSD is followed by high beta waves (16–20Hz) and decreased alpha (8–12 Hz) and theta (4–8 Hz) waves. Consequently, standard neurofeedback (NFB) training for post-traumatic stress disorder in adults comprises alpha-theta training [29]. Dealing with children, we introduced SMR (12–16 Hz) training which we consider as more adequate for children. The increasing of SMR intensity by NFB was from mean 6.344 to 7.176 (in μ V). So, by EEG-operant conditioning we obtained higher SMR followed by relaxation, motor control, and lower beta (lower arousal).



EDR (in KΩ) SMR-NFB(in μV)
Figure 5. The change of biofeedback indicators for PTSD

In essence, neurofeedback is based on monitoring neuronal synchrony (local and global) and shifting the frequency bandwidth by operant conditioning training. An important finding of neurofeedback research and clinics is that global (i.e. long-distance) synchrony represents a physiological mechanism of attention [30]. Our studies of attention deficit disorder in children have also shown a positive correlation between attention and increased synchrony in the high (beta) frequency range. [31] The next step would be to check the recommendation to combine training both high (beta) and low (alpha and theta) [32]

5. Conclusion

As it was shown all children manifested PTSD in the early period of life and the clinical presentation was disproportionally greater according to the real level of trauma. This could be correlated to the fact that all of them had an insecure attachment. The social conditions (war, economic poverty) have been the additional background for PTSD.

In our treatment we used supportive and behavior-cognitive therapy, combined with EDR and EEG-SMR biofeedback training. The results obtained are very encouraging. The symptoms of PTSD in all children had been eliminated after 20 sessions EDR /EEG biofeedback (one session of 50 minute duration per week).

In brief, two general conclusions can be deduced: (1) The lack of secure attachment, confirmed in all children the examined, contributed to early predisposition to PTSD, related to non-developed ROFC; and (2) Multimodal biofeedback technique is a good complementary tool for both assessment and therapy of PTSD in children.

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Резиме

ТРАУМА ВО ДЕТСТВОТО, РАНО ЕМОЦИОНАЛНО ВРЗУВАЊЕ И БИОФИДБЕК

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Цел на студијата е да се истражи поврзаноста помеѓу квалитетот на раното емоционално врзување и ефектите на траума во детството, како и воведување на некои понови терапевтски приоди.

За таа цел, селектирана е група на деца со пост-травматско стресно растројство (PTSD) дијагностицирано со ICD-10. Средната возраст на пациентите е 9 ± 3.05 години, од обата пола (девојчиња 3 и машки 7).

Мајките и децата се испитувани со батерија психометриски инструменти Минесота мултифазен инвентар на личноста (MMPI), Чеклиста за поведението на децата (CBCL), Ајзенков инвентар на личноста (EPQ) и Инвентар за анксиозност (STAI). Како дополнение на класичните психотераписки методи (поддршка, терапија на поведение и терапија низ игра) воведоме мултимодална компјутеризирана биофидбек техника како за проценка така и за терапија.

Добиените резултати кај децата покажаа високо ниво на анксиозност и стрес, соматизација и проблеми во однесувањето (агресивност, импулсивност, непослушност, ноќни мори), кај мајките постоење на хиперсензитивност и депресивност, како и елементи за лошо емоционално врзување во најраниот период од животот на децата. Следствено на тоа, објаснувањето за раната предиспозиција спрема пост-травматско стресно растројство е поврзана со неразвиен десен орбито-фронтален кортекс (ROFC). Ова е последица на несигурното рано емоционално врзување, потврдено кај сите испитаници.

Тераписките резултати добиени со биофидбек техниките се охрабрувачки.

Клучни зборови: рано емоционално врзување, биофидбек, детска траума, пост-травматично стресно растројство.