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Acute Post-Traumatic Stress Reactions in Children Survivors of a Large Road Traffic Accident: Epidemiological Analysis and Eye Movement Desensitization and Reprocessing Treatment

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Abstract

Introduction: In the last years, Post-Traumatic Stress Disorder played a leading role in clinical research, together with its *Eye Movement Desensitization and Reprocessing (EMDR)* treatment. The analysis of the effectiveness of the treatment through EMDR on post traumatic symptoms is the subject of this survey, which was experienced on a group of children being victims of a serious car accident and on their parents, comparing it with other English research.

Method: This survey is based on the study of the reduction in Post-Traumatic Stress Disorder symptoms on some children attending primary school, involved in a serious school bus accident. Through a statistic analysis of the replies to the questionnaires and interviews before and after the treatment, the non-spontaneous remission of the three clusters (intrusivity, avoidance, and arousal) for the group of children not treated has been the subject of this study. Two different groups established, thanks to the different times of access to treatment: a so-called experimental group and the control one.

Results: The results obtained through this survey provided some very important records on the number of children developing a post traumatic syndrome after a serious event. We found out that without treatment, reactions can last several months without evolving into a spontaneous remission, as from the records of the delayed treatment control group, smaller than the experimental one, showing a higher percentage of post traumatic symptoms. From the records appeared after the clinical interviews on parents and on the effectiveness of Eye Movement Desensitization and Reprocessing (EMDR) treatment carried out with them, it is clear the strong need of a psychotherapeutic intervention, also with parents and caregivers of children victims of a traumatic experience.

Conclusion: This survey was a real success considering the compliance to treatment, if compared with other research in current literature. Above all, it was relevant to underline the importance of a prompt intervention, focused on acute phase of trauma. EMDR actually played an effective role in the therapy with children.

Keywords: Post traumatic stress disorder; EMDR; Effectiveness of the treatment; Remission of the symptoms

Introduction

On May 9, 2007, at approximately 05:30 p.m. a school bus overturned, after swerving for a few minutes, in a small escarpment on the highway.

The 41 children on the bus, who belonged to all five classes of the Stroppiana (VC) primary school, were returning from a school trip to Turin, together with 3 teachers.

The outcome was tragic: a 7 years old boy died instantly. Another child of the same age, hospitalized in critical conditions, died the following day at the Turin hospital. His brother 10 years old was hospitalized in a coma and woke up a few days later. One of the teachers was hospitalized in the intensive care unit.

The small Stroppiana community, approximately 1200 residents, was overwhelmed upon hearing the news and the parents, who were waiting for their children in the square at the center of their village, started travelling to the accident site or to the hospital, hoping to hear good news, but for several hours nobody was able to tell them whether their children were wounded, unhurt, or had died.

This event was one of the most dramatic in Italy in 2007, since this mass disaster affected the entire community. The first triage and screenings showed the need for a psychological intervention to reduce stress-related reactions and promote coping strategies. The psychological triage was performed by the psychologists of the pediatric neuropsychiatry unit.

Survivors were given support to provide safety and comfort, alleviate suffering, reduce arousal, promote resilience and coping strategies, both short and long-term.

Nevertheless, during the first stages of the psychological intervention the pediatric neuropsychiatric team saw also the need for a specialized intervention. Three weeks after the accident an intervention programme with EMDR was set. The selection of EMDR as treatment of choice with this group followed DSM IV "A" criteria for Post-Traumatic Stress Disorder (PTSD). In fact, this accident presented

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the dramatic features of a traumatic event (the trauma of the actual accident and the grief for the death of the 2 children). This traumatic experience included experiencing, witnessing, or confrontation with an event involving a serious threat to their own life and being exposed to peers' death.

This group of children and their parents met the diagnostic criteria for Post-Traumatic Stress Disorder and had a special risk factor which was their developmental age. In the developmental age, lacking a focused and timely intervention the child personality can develop around the trauma and adapt to it, leading to the likelihood of developing psychological disorders at a later stage.

In Great Britain studies were conducted on children involved in road traffic accidents [1,2] which are the most frequent cause of accidental death in children. These studies compared the psychological reactions developed in adults and in children. Adults were found to experience mainly mood disorders, travel anxiety, depression and post-traumatic stress disorders, the latter, on the other hand, experience the typical symptoms of the post-traumatic stress disorders (DSM-IV, APA).

The sample for one of these British studies [2], was recruited using the hospital records and the subjects who joined (approximately 42 % of the people contacted over the phone) were randomly allocated to an experimental and a control group (waiting list).

30 % of the participants met diagnostic criteria for Post-Traumatic Stress Disorder during the first interview conducted immediately after the accident.

Method

The Intervention was organized and authorized by the local Sanitary Department of the National Health Service and approved by the Ethics Department of the ASL Vercelli, who was responsible of mental health prevention and interventions. The local school district and the parents requested the intervention and gave their informed consent to EMDR treatment, being EMDR an evidence based therapy for Post-traumatic stress disorder it was chosen because of its effectiveness.

Psychological treatment with EMDR was immediately implemented and the setting was the primary school, as reported in former EMDR field studies with children survivors of mass disasters [3,4].

Parents of the children were invited with a letter from the local public health authority (ASL) and the school management; to attend psycho-educational meetings were explanations were given on post-traumatic reactions on children and on EMDR as trauma treatment. Informed consent on the therapy was collected, and doubts and concerns addressed.

This project can be considered a quasi-experimental study. This choice was made because of ethical concerns. In fact, we avoided randomizing the children and we treated as many children in deep distress as we could 77% of the children, i.e., almost the whole sample joined the project. A group of families accepted the treatment proposal few weeks after the event; at a later stage, a smaller delayed-treatment group was added and constituted the control group consisting on those children whose families joined the project at a later stage.

Out of the 39 survivors who were on the bus, 30 families accepted the treatment proposal with EMDR for their children. A first group was provided with a cycle of sessions one month after the event; a second group (called delayed control group) applied more than 3 months after the event (many families were on holidays in June).

In the pre-treatment assessment all children were individually administered a set of tests and a clinical interview, conducted by homogeneous and independent assessors (psychologists of the local mental health unit) to measure post-traumatic symptoms.

This analysis included the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID I-CV) for Post-Traumatic Stress Disorder [5] and the Child Report of Post-Traumatic Symptoms [6], directly administered to the children, as well as the Child Dissociative Checklist [7], and filled by the parents on their children's condition.

Then a cycle of 3-8 EMDR sessions was administered to each child, with an average of 6 sessions. The traumatic memories targeted with EMDR were related to the worst moments of the accident and to the news of their schoolmates' death, as well as the current anxiety-triggering (present anxiety) and anticipatory anxiety situations (future) [8].

The post-treatment evaluations, one week after the end of the cycle of EMDR sessions, consisted in the administration of the same tests administered in the pre-treatment phase. The same was done at the 1-month, 3-months and 1-year follow-ups, where the post-traumatic symptoms trend was monitored after EMDR treatment.

The intervention was conducted with a group one month from the event to measure symptoms in the acute phase (which goes from 3 months from the event), and with another group more than 3 months after the event to assess chronic conditions symptoms. This was done to verify whether a large percentage of post-traumatic symptoms subside spontaneously in children, as claimed by the DSM IV-TR.

Considering the high traumatization level experienced by the parents waiting for news about their children [9] and the teachers' involvement in the accident (primary victims), adults too were offered the opportunity to have a program of EMDR sessions.

24 adults including parents, teachers and the school principal, were assessed and treated. The psycho-diagnostic assessment for adults consisted on the SCID I-CV (Post-Traumatic Stress Disorder part) like the children, and the Impact of Event Scale-Revised [10]. The same programme used for children (pre-treatment, post-treatment, 1-month, 3-months and 1-year follow-up) was used for adults too.

Approximately 235 assessments were conducted by 8 independent assessors, and 8 clinicians conducted a total number of 275 EMDR sessions.

The therapy was entirely conducted at the children primary school, thanks to the close cooperation of the school principal. This natural setting for children facilitated acceptance and cooperation and at the same time avoided the risk of pathologizes their reactions.

Treatment

During the first assessment in the acute phase we found out that 43% of children developed the diagnostic symptoms for Post-Traumatic Stress Disorder (PTSD) and 34% had post-traumatic symptoms even if they were not presenting full blown PTSD.

The high level of both full-blown and under-threshold or subclinical PTSD symptoms, clearly confirmed the need of a specialized psychological intervention like EMDR, in order to help these children deal with symptoms and try to improve their condition (Figure 1).

All children involved in the accident, including those with few isolated symptoms or without any symptom, were treated with EMDR

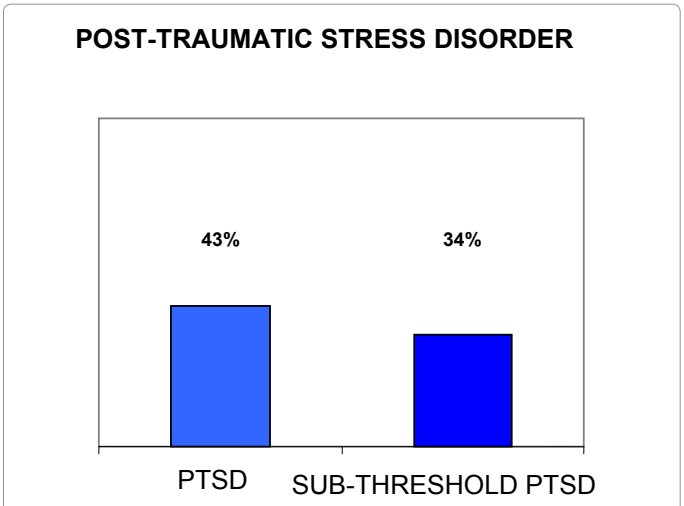

Figure 1: Post-Traumatic Stress Disorder Percentage in children (pre-treatment).

on the memory of their traumatic experience. This gave all of them the possibility to process the subjective distress caused by the memory of the accident. Furthermore, although these children did not suffer from PTSD with full-blown symptoms, they had disturbing emotions and sensations related to the accident. Targeting these elements with EMDR has a prevention value against other extreme stress reactions likely to be reactivated by eventual future events that can be associated to the trauma. In fact these experiences can remain dysfunctionally stored in the memory and constitute a risk factor for the future.

Each group of children received an average of 6 EMDR sessions of approximately 60' each in consecutive days. The standard EMDR protocol was used and the sessions were conducted by clinicians that were experts in psychotraumatology of the developmental age. The EMDR sessions were conducted using the standard protocol, i.e., the fidelity criteria defined by scientific research on this method. The assessments were conducted by local Health Public Service psychologists and by psychologists who did not conduct the therapy sessions and, therefore, were independent assessors. After the EMDR treatment preparation phase, where the method was explained to the children and their parents, subjects were introduced to the alternate bilateral stimulation with the installation and processing of a positive memory (safe place), providing a feeling of well-being and safety.

The EMDR sessions focused on the memories of the accident, identifying the images of the worst part of the experience, the self-referenced irrational beliefs related to that image, as well as disturbing emotions and physical distress. Bilateral stimulation was then applied until full desensitization of the memory-related emotional distress. The memory was then associated to a positive self-belief (e.g. "I am safe", "I can rely on myself", etc.), until the child felt it completely true.

At the end of the sessions, a check was made on the absence of any residual tension in the body through a body scan.

After using this procedure to process the traumatic memories, EMDR was used to target present anxiety provoking situations (e.g. taking the bus to go to school, travelling by car, etc.) associated with the traumatic event.

After processing these present emotional symptoms, a future template was set to prepare the subjects to face and deal with potentially anxiety-provoking future situations. In this way a comprehensive work on the past, present and future related to the traumatic experience was completed.

The treatment took place during 2 consecutive weeks (Friday, Saturday, and Sunday); therefore the sessions were conducted over 3 consecutive days.

Results

Subjects in the developmental age

Approximately 235 test assessments were conducted between July 2007 and May 2008, at different stages of the study, a pre-treatment and a post- treatment session for all patients, and several follow-ups for both groups (experimental or control group).

The first group, consisting of those who immediately joined the program, was tested a total of 5 times: pre-treatment, post-treatment, 1-month, 3-months and 1-year follow-ups. The second group, which will be called delayed-treatment control group, was tested a total of 4 times: pre-treatment, post-treatment, 6-months and 1-year follow-ups.

Considering all participants we have worked with a total of 30 children out of the 39 who survived the disaster, i.e. almost 77% of the original population, 63% of which in the treatment group and 37% in the delayed treatment group (2 drop-outs in this group), over one year (Table 1).

During the first assessment, children showed a rather clear picture of the symptomatology and of the emotional reactions they developed following the accident, as well as after the loss of their two schoolmates. In fact approximately 77 % of the sample developed post-traumatic stress disorder symptoms (43% of which PTSD and 34% subclinical PTSD. The remaining subjects reported only few isolated symptoms, which could not be considered subclinical.

After comparing the pre-treatment and post-treatment assessment data, two children were excluded from the statistical analysis since they dropped-out after the first test battery and two more children since they failed to show-up for reasons not related to the intervention.

If we consider the diagnosis, we can see that after the EMDR treatment no child met criteria for Post-Traumatic Stress Disorder: the T-test for two-tails paired samples produced a value for T= 4.05 and α = $ 0.000, highly significant.

This result was also confirmed in the 6-months follow-up, showing a partial relapse of the disorder (8%) with T=3.33 and α=0.003. In the 1-year follow-up the PTSD diagnosis subsided again.

Substantial improvements over time could be observed also for the subclinical group. In fact, the high value recorded in the first assessment decreased substantially in percentage after treatment. Only 4% reported the symptoms (T= 2.86 and α=0.01). In the 6-months follow-up the percentage was 8%, and the same in the 1-year follow-up with highly significant data (T= 2.27 and α=0.03) (Figure 2).

On the other hand the percentage of subjects reporting only few, or no symptoms at post- treatment reached a high number; at the beginning only 23% of children were in this group. After treatment 96% of all 30 children had no symptoms or very few and in the subsequent follow-ups (84% and 92% respectively), so it was maintained (Figure 3).

In brief, we can see from examining the graphs (for the diagnosis) that symptoms have the following trend: many symptoms at pre-treatment, almost none at post-treatment, few at the first follow-up and

	First half of July 2007	Second half of July 2007	End August 2007	Mid September 2007	Mid January 2008	Mid May 2008
First group	Pre-treatment (19 children)	Post- treatment (17 children)	Follow-up 1 (19 children)	/	Follow-up 2 (17 children)	Follow-up 3 (18 children)
Delayed group	/	/	Pre-treatment (9 children)	Post-treatment (7 children)	Follow-up 1 (6 children)	Follow-up 2 (6 children)
January group	/	/	/	/	Pre-treatment (2 children)	/

Table 1: Administration and assessment schedule.

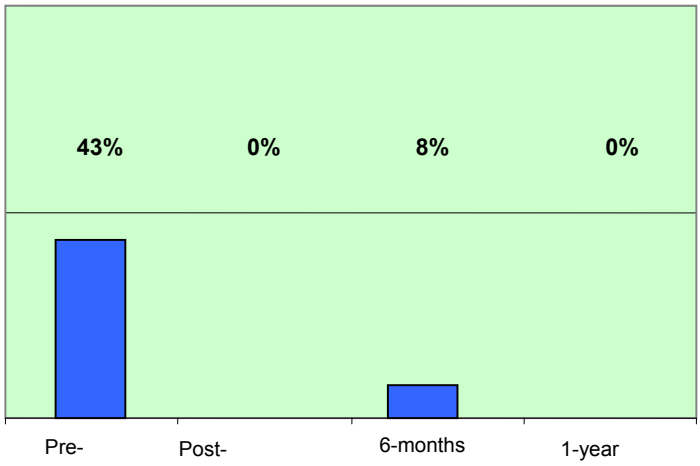

Figure 2: Post-Traumatic Stress Disorder Percentage in children.

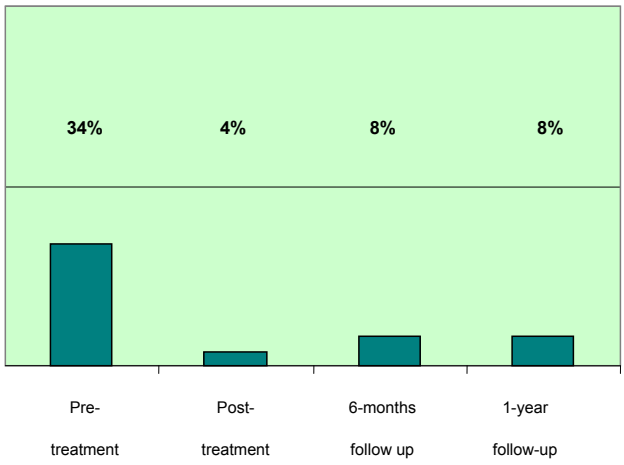

Figure 3: Percentage of subclinical post-traumatic stress disorders in children.

almost none at the second follow-up. This situation has been recorded both for the diagnosis and for the analysis of the three clusters taken individually, where it was noticed that the cluster relapsing most frequently was the increased arousal (at 1year) (Figure 4).

Adults

A total of 24 adults joined the program but data regard only 15 subjects, since for the remaining 9 cases one or more measures were missing.

Table 2 summarizes the trend of adults' attendance in the assessments and evaluation interviews.

Overall 78% of those who were administered the initial assessment

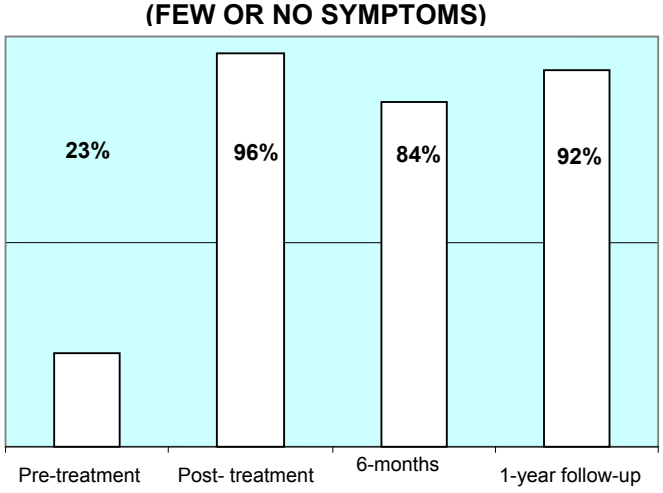

Figure 4: Percentage of Post-Traumatic Stress Disorder (few/no symptoms) in children.

(24 subjects) reported a Post-Traumatic Stress Disorder or a subclinical PTSD, and the remaining 22% included those who developed few symptoms or no symptoms at all.

In the analysis of the sample considered (subjects without pre-treatment and post-treatment assessments were excluded), 69% of the adults receiving the test battery had a full-blown (38%) or subclinical (31%) PTSD at pre-treatment, and the remaining 31% reported only few symptoms (19%) or none at all (12%) (Figure 5).

Surveys at post-treatment showed immediate improvements and this confirms the claim of the immediate effectiveness of EMDR in acute Post-Traumatic Stress Disorder. Statistics also confirms this significant level. In fact, one week after the sessions no patient suffered from full-blown Post-Traumatic Stress Disorder anymore. The statistical comparison with the T-test, produced a value of T=3 and α=0.01 between the two surveys.

Only 6% was included in the sub-threshold category, also a significant percentage confirmed by the values of T=2.24 and α=0.04. On the other hand, 81% of the sample no longer had symptoms (T= -5.75 and α = 0), and 13% still showed few signs of the previous pathology (a less significant value with T= 0.44 and α= 0.4 because it is not very different from the previous evaluation) (Figure 6)

In the two subsequent follow-ups there was a slight symptoms relapse, though not clinically or statistically meaningful.

In fact, in January 2008, 9% experienced a relapse of Post-Traumatic Stress Disorder, while in May 2008 the percentage dropped to 6%. 29% of subjects at the first and 27% at the second follow-up were sub-threshold. 38% experienced few symptoms at 6 months follow-up and 40% still suffered of some symptoms after one year. Lastly, 24% and 27% did not experience any symptoms. So, during the 6 months and one year follow-up we can observe some reactivation of symptoms even if not clinically significant. After treatment their response was good, specially the group with Post-Traumatic Stress Disorder (Figure 7 and Figure 8).

Another analysis was conducted to compare the type of disorders experienced by adults as a function of the pre-treatment assessment date (acute and chronic phase).

The July group included 14 adults, and in the subsequent period, i.e., in the August group, 8 subjects were assessed and, finally, the January group consisted of only two new pre-treatment assessments.

The results obtained are included in percentage in the Figure 9.

Figure 9 clearly shows that, as stated in the DSM IV-TR, about half the subjects develop a Post-Traumatic Stress Disorder in the acute phase (within 3 months from the event), and that, after about 3 months, half the cases show a spontaneous remission. In fact only 25% of the group first assessed in August suffered from Post-Traumatic Stress Disorder before treatment. It is very interesting to note that the 2 adults first assessed 8 months after the event had sub-threshold, subclinical or no symptoms before treatment. Their number is too small to draw clinical or epidemiological conclusions. The trend of adults' reactions follows

	Pre-treatment	Post-treatment	6-months follow-up	1-year follow-up
Adults	24	16	15	15

Table 2: Adults' attendance at the assessment dates (one group).

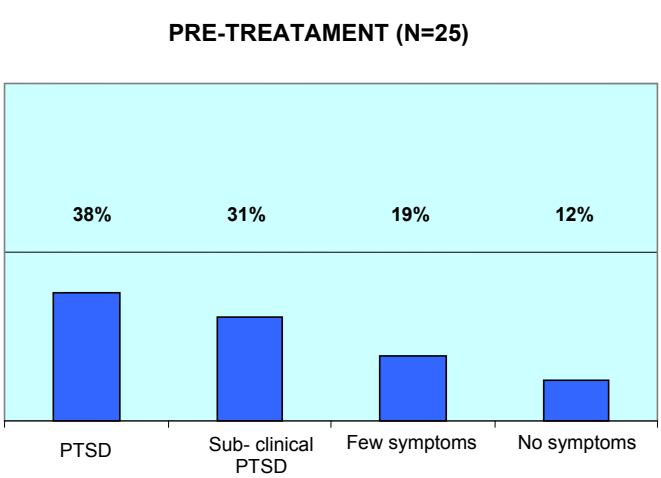

Figure 5: Post-traumatic stress disorder percentage in adults (pre-treatment).

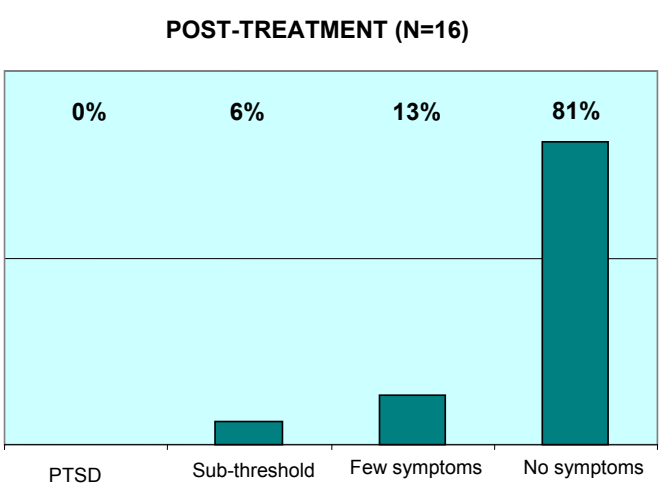

Figure 6: Post-traumatic stress disorders percentage in adults (post-treatment).

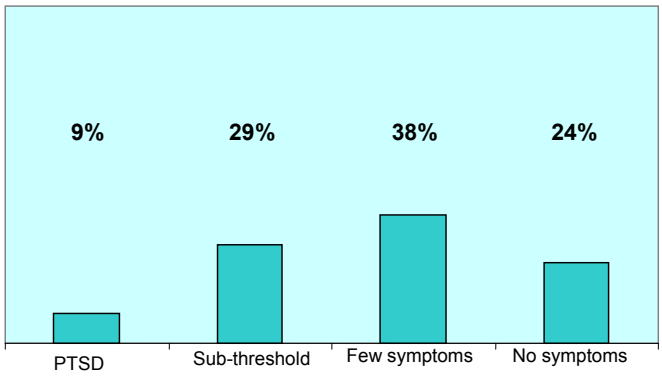

Figure 7: Post-traumatic stress disorders percentage in adults (6-months follow-up).

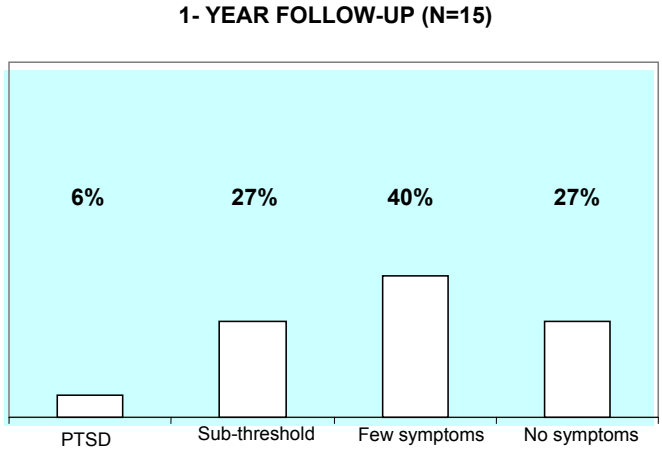

Figure 8: Post-traumatic stress disorders percentage in adults (1-year follow-up).

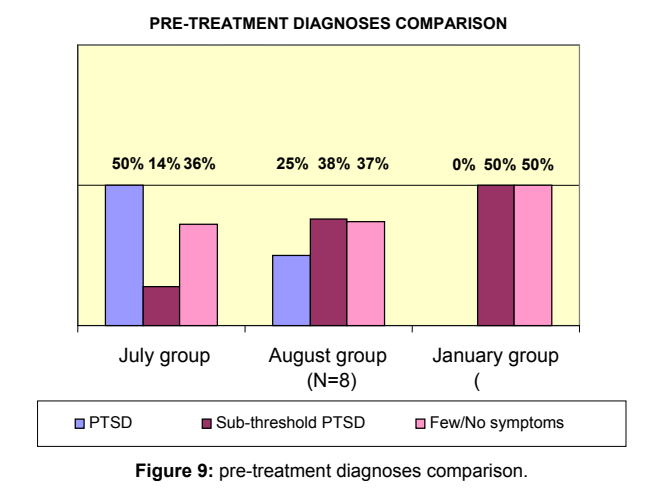

Figure 9: pre-treatment diagnoses comparison.

the conclusions of the literature about the incidence of Post-Traumatic Stress Disorder in populations exposed to traumatic events. But the under-threshold condition seems to be important and might have a key role on survivors of mass disasters and trauma, since we have observed that even the PTSD tends to subside over time, the subclinical symptoms tend to get higher over time. The subclinical group remains with an important risk factor for their mental health and also with subjective suffering.

Analysis by clusters

43% of children were diagnosed with post-traumatic stress disorder in pre-treatment assessments. After treatment, the second assessment showed important results: only one subject continued to suffer from Post-Traumatic Stress Disorder symptoms, 27% experienced "subclinical" symptoms and almost 70% had few isolated symptoms or even no symptoms at all. Similar results were obtained in later follow-ups, where results were maintained.

The difference proved to be significant also in the analysis by clusters. In fact the symptoms average decreased between pre-treatment and post-treatment: for instance, intrusiveness symptoms in the SCID-I the value decreased from 2.77 symptoms before treatment to less than one symptom (0.2) after treatment, associated with a value of $\alpha = 0$, indicating a highly significant data. In the 6-months follow-up the average rose to 0.9 and then dropped again to 0.2 in the last assessment.

The avoidance symptoms average dropped from 3.4 symptoms to 0.4, i.e. less than one symptom at post-treatment (and in all later assessments). This is confirmed by a value of $\alpha=0$. The 6-months follow-up shows a partial symptoms relapse (0.8), decreasing to a very low value (0.2) one year from the accident.

Similar data were obtained also for the arousal increase, from an average of 2.2 symptoms at pre-treatment to 0.2 in the subsequent assessment. Here too at the 6-months follow-up the cluster has a value of about one symptom (0.9); the difference with the two other clusters is in the 1-year follow-up: in fact, the hyper-arousal symptoms average, though low (approximately 0.5), is higher than those of Intrusiveness and Avoidance.

The trend of the disorder was slightly different in adults. 38% of the subjects had PTSD before treatment, while no signs of the disorder were experienced at post-treatment.

The difference between children and adults was mostly evident at follow-ups; in fact 6% of adults experienced a relapse of the disorder after one year.

Discussion

This project started in June 2007 and continued for over a year until May 2008 and led to important results in terms of support of the effectiveness of EMDR treatment with children, as well as with adults in the aftermath of a mass disaster.

An important aspect of this project is the participation of a large percentage of the population involved in the accident. In fact out of 39 children who survived the accident, 30 attended the first assessment, i.e. 77% of the population involved in the accident.

If we compare this result with those published in the literature, we can consider a very high representativeness of the sample analyzed.

An English study [2] made with children involved in road traffic accidents, for instance, reported a compliance with the treatment interventions of 42% of the initial sample, with a PTSD development percentage of approximately 29%.

This field study seems more representative as a sample due to the fact that there was almost a total participation of the subjects to the study, and that might be the reason why the PTSD rate is higher than was is found in other studies. 43% of these children developed post-traumatic stress disorders and 34% were in the subclinical category.

In terms of Post-Traumatic Stress Disorder incidence, based on the children allocation to the groups, full-blown Post-Traumatic Stress Disorder was found in 37% of the first group in acute phase and in 44% in the second (control) group, while the subclinical category reached 32% and 44% respectively. Consequently acute post-traumatic stress symptoms did not subside 3 months from the event as postulated in the DSM IV-TR, but, lacking specialized treatment, they increased (from 69% symptomatic to 88%) (Figure 10).

The results obtained after treatment have been important to highlight the effectiveness of the EMDR approach, both immediately and long-term in the acute symptomatology of post-traumatic stress disorders and confirm some findings published in the literature especially with respect to the application with children.

The symptoms development is different between adults and children. Children seem to have experienced high stress reactions as confirmed by the results of the survey of the three symptoms clusters during treatment.

Adults stress reactions were also significant: the amount of Post-Traumatic Stress Disorder diagnoses at pre-treatment led us to consider the need to intervene with EMDR treatment with parents as well.

In this project, parents were immediately trustful and allowed their children to receive psychological interventions provided by the team of the local public mental health unit (ASL Vercelli) and EMDR clinicians.

The psychological team of the local mental health unit was fundamental in managing the emergency situation developed in the immediate aftermath of the event; they met with survivors and their parents at the hospital, and provided support to deal emotionally with such a critical event. They also provided some psychological first aid in order to promote coping skills and resilience.

This project was also supported and enhanced by the town hall and by the School principal.

In fact, thanks to the good cooperation of a multi-disciplinary team it has been possible to work with the children in a setting familiar to them such as their school. The availability of this setting has certainly facilitated the acceptance of such a large number of children and fostered the emotional reactions' normalization process.

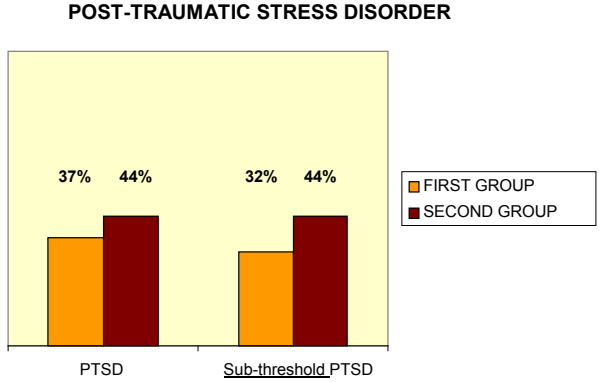

Figure 10: Post-Traumatic Stress Disorder percentage in the two groups of children.

The results of the work conducted (especially the analysis of the answers to the items of the SCID scale, confirmed by the data obtained from the CROPS for children and the IES for adults) provided important data on the number of children who developed a post-traumatic syndrome after a critical incident. Reactions may persist for several months without spontaneous remission, as confirmed by the data obtained from the delayed-treatment comparison group, where 44%, suffered from PTSD 3 months after the accident. Children with many symptoms but that did not have a full-blown PTSD (subclinical group) were seen also in great need of clinical treatment since they were very disturbed by their symptoms and showed a great subjective suffering. They responded well to EMDR treatment as did the clinical group.

Finally, both the epidemiological data on the incidence of Post-Traumatic Stress Disorder in the developmental age stemming from our study and the results obtained with a cycle of 6 EMDR sessions (average) with the survivors, support the claim of the importance of a specialized clinical intervention in the acute as well in the chronic phases of post-disasters. EMDR has proved an effective treatment tool with children, and provided interesting findings likely to expand research on these epidemiological and clinical issues.

The data drawn from the psychodiagnostic survey with parents on the effectiveness of the EMDR treatment program conducted with them support the strong need for a specific intervention also for the caregivers of children victims of trauma.

Acknowledgement

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