
Equine-Assisted Therapy as a Complementary Approach for Adolescents with Post-traumatic Stress Disorder: A Preliminary Study After a Terrorist Attack

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Abstract: Equine-Assisted Therapy (EAT) is a complementary therapeutic approach for children and adolescents with post-traumatic stress disorder (PTSD), and recent scientific studies show the benefits. Therapy with the mediation of the horse facilitates the therapeutic alliance and improves social skills, emotional regulation, and resilience. The purpose of this study is to describe goals, modalities, and benefits of equine-assisted therapy for adolescents with PTSD, and to analyze how and why these results are obtained. Ten EAT sessions were offered to two adolescents with PTSD following a terrorist attack. According to the observed symptoms, the therapeutic objectives and modalities are established and described. The evaluation is based on a self-evaluation by the adolescents, and on an EAT observation grid. The results show a positive evolution, with a very strong alliance and participation. Equine-assisted therapy facilitated adherence to care, improved socio-emotional and cognitive functioning, helped regulation in behavior and emotions, restored confidence and self esteem, and provided wellness. Understanding the action of EAT for children and adolescent with posttraumatic stress disorder helps to explain the benefits and effectiveness of this complementary therapy. The factors involved are analyzed according to several approaches: psycho-affective, cognitive, social, neurobiological, and therapeutic. Studies need to be continued with larger samples to obtain evidence-based data and to validate the results of equine-assisted therapy in adolescents with PTSD.

Keywords: Post-traumatic Stress Disorder, Equine Assisted Therapy, Adolescent, Complementary Therapy

1. Introduction

Post-traumatic stress disorder (PTSD) is a pathology related to major stress occurring during exposure to a traumatic event, leading to various consequences, in particular an impairment of emotional regulation and emotional memory [2]. Evolution is influenced by psychological, socio-environmental, genetic, and physiological vulnerability factors.

Equine-assisted therapy (EAT) is a complementary approach to conventional therapies. Equines (horses, ponies) are increasingly involved in the care of people in difficulty. Evidence from current scientific studies shows positive results [11, 8, 13]. The objective is to use the horse as a mediator in therapy. It is not a question of learning to ride, but of assisted

care with the horse.

The modalities are established based on a personalized project integrated into the overall therapeutic program of the beneficiary. In the case of children and adolescents, the parents are involved and informed of the objectives of the therapy and the progress made [8]. The therapist must be trained in equine assisted therapy, with a good experience with horses, to carry out the sessions in optimal safety conditions. The therapist must be calm, predictable, and supportive. Indeed, the therapist's behavior and emotions affect both the horse and the patient.

The sessions usually take place in an equestrian center, in a calm, soothing and safe environment, in small groups or individually. It is necessary that the horse (or pony) is wise,

tolerant, and well educated. During about an hour, various activities are carried out: observation of the horse in the box and in freedom, preparation of the horse, grooming, putting on the saddle and the bridle (or halter), riding in a riding arena (secure, quiet place) or outside (environment richer in stimuli).

In the field of PTSD in children and adolescents, the complementary therapeutic approach with equine-assisted therapy is an innovative practice. It has the advantage of being more easily accepted than conventional therapy. Numerous studies have shown the benefits in adults, especially veterans [4], but there is still little work on children and adolescents with PTSD. Research in this field is hampered by methodological difficulties [9] which may lead to limitations in the interpretation of results.

Three studies concerning children and adolescents are particularly interesting. Schultz, Remick-Barlow and Robbins evaluated the results of equine-assisted psychotherapy for 63 children victims of domestic violence and abuse. The results show an improvement for all subjects, especially for the youngest, and this improvement is related to the number of sessions [17]. Kemp, Signal, Botros, Taylor and Prentice evaluated an equine-facilitated therapy program for 30 children and adolescents victims of sexual abuse. Results showed significant improvement regardless of age and gender [12]. Mueller and Mc Cullough evaluated the results of equine-facilitated psychotherapy for 36 children and adolescents with signs of post-traumatic stress, in comparison with a control group of 32 children and adolescents receiving traditional trauma-focused therapy. The authors concluded that both groups improved, with no significant difference, thus showing that equine-facilitated therapy is as effective as usual therapy [15].

A case study was conducted in France in 2021 by Hameury and Rossetti for children with posttraumatic stress disorder of various origins. Ten sessions of equine-assisted therapy were offered to a group of 3 children, aged 6 to 11 years. The results show good adherence to the treatment and progress in all targeted areas [10].

There is thus a beginning of evidence in favor of the interest of equine mediation as a complementary therapy for children and adolescents suffering from post-traumatic stress or complex trauma.

The purpose of this study is to describe goals, modalities, and benefits of equine-assisted therapy for two adolescents with PTSD following a terrorist attack, and to analyze how and why these results are obtained.

2. Method

2.1. Population

Equine-assisted therapy (EAT) was offered to two adolescents from the same family, a girl B. aged 18 years and a boy S. aged 14 years, suffering from post-traumatic stress disorder persisting beyond two years. These disorders emerged in the aftermath of the July 14, 2016, terrorist ram-truck attack in Nice, France, which killed 86 people and injured 458. The two teens and their parents were at the scene

of the attack, witnessed the attack, were not injured but were caught up in the flight of the crowd and confused at the sight of the massive number of dead and injured.

The daughter B. received psychological care from the medical-psychological emergency unit (CUMP), which intervened at the scene of the attack, and was then referred to the child psychiatry department. Two and a half years after the attack, she was suffering from anxiety crisis with hypervigilance, increased at nightfall, and had set up rituals of verification and reassurance at bedtime. It was difficult for her to express her emotions.

The boy S received psychological care from the CUMP and was then also referred to the child psychiatry department. Two and a half years after the attack, he showed anxiety, a significant reduction in social interactions, with withdrawal and difficulties in leaving home. His outings were limited to the home to school and back, and he had a profound feeling of insecurity when he was obliged to go outside, with the sensation of being constantly observed and judged, going as far as a state of panic with a feeling of persecution. He had to be accompanied by a family member when going out. Difficulties in managing his emotions were most often expressed in anger and irritability towards his peers.

The parents also suffered from PTSD. The father, aged 66, was treated by the CUMP and then underwent psychiatric care at the medical-psychological department, combined with medication. He was still suffering from anxiety disorders. The 46-year-old mother spoke with the CUMP caregivers present at the scene but did not accept the proposed care. She presented with an intense post-traumatic stress syndrome with reliving, psychosomatic reactions, depressive disorders, a traumatic experience, and a loss of quality of life.

2.2. Modalities

These two adolescents benefited from a 10-week session of equine-assisted therapy. They participated together in weekly sessions, each lasting 1.5 to 2 hours, which took place from October 2019 to January 2020. They had never had contact with a horse before.

Equine-assisted therapy was performed by the equitherapist, trained in psychotrauma therapy (psychotraumatology UD of University Côte d'Azur) [16]. The sessions took place in an equestrian center, in a secured area, with a horse and a large pony trained to equine mediation.

The activities included the care and preparation of the horse (grooming, saddling), observation of the horse in freedom and interactions with it, leading the horse in hand (the teen walking next to the horse), mounting the horse, various play activities, and at the end of the session, horseback rides in the park next to the riding center.

Before the first session, a meeting with the whole family took place to present the structure, the horses, and the team of the equestrian center, as well as the framework of the sessions and their evaluation.

At the beginning of the first session, the framework and the rules were established: confidentiality and safety rules with the horses.

Then each beginning and end of the sessions were dedicated to a time of common exchange with the children and the parents (when they were present). The participants were asked how they perceived the exercises, the difficulties they had encountered, their experiences during the week between the two sessions, the presentation of what was planned for the day's session and any questions or comments they had.

The objectives sought concerned the search for well-being, relaxation and appeasement; the improvement of the relationship with others and social skills; the assertion of oneself in front of the animal and one's peers; the reinforcement of self-esteem; the bond of attachment to the animal; the management of emotions and separation; sensoriality (exploration of the senses, perception of one's

own body, refocusing on pleasant sensations); the verbalization and management of the emotions felt; cognitive remediation: working on inappropriate thoughts and positive thoughts, trauma memory, disconnecting memory and emotion.

The parents attended and participated in sessions 1, 2, 3 and 10 and received external psychological follow-up.

2.3. Evaluation

The evaluation was qualitative and quantitative, based on the EAT observation grid (table 1), elaborated, and rated by the equitherapist [16].

Table 1. EAT observation grid.

	Score 1	2	3	4
Contact with horse	indifference towards the horse	remains reserved despite a certain interest	interacts punctually with the horse	goes to the horse, interacts with it
bodily engagement	passive attitude, stays in the background	moves in a fixed way, hesitates	interacts with the horse but no appropriate control of gestures, postures	moves towards the animal, interacts in an adapted way
assertiveness	passive attitude, slowness	manages to raise the tone of his voice at times	able to assert himself but only occasionally	can assert himself in front of the horse if necessary
emotional managing	frozen facial expressions and gestures, indifference	manages to express himself punctually, on request	can enrich his vocabulary to describe what he feels	easy emotional expression
autonomy	passivity, does not know what to do	hesitation, seeks help by looking	makes efforts to succeed	shows initiatives and appropriate actions
verbal communication	absence of voice modulation in requests, little oral expression	episodic variation in voice modulation, speaks only in response to questions asked	can modulate the tone of his/her voice appropriately, speaks in a spontaneous way	speaks easily, asks questions, knows how to use his voice to communicate with the horse

3. Results

3.1. The Sessions

The objectives of the *first session* were to promote trust, tuning between the adolescent and the horse, family cohesion and reassurance. It highlighted the difficulties of the daughter B. in overcoming her fear of contact with the horse and in establishing a relationship of trust with it. Son S. showed no apprehension, but his emotional distance did not allow him to establish a trusting relationship with the horse, which led to frustration and then anger. At the end of the session, the expression of their feelings was positive, both teenagers said they were enthusiastic and eager to come back.

During *session 2*, unexpected environmental conditions reactivated the traumatic memory and caused anxiety and hypervigilance. The grooming activity was able to provide relief. Verbal expression of emotions allowed discussion about the anxiety caused by the reminiscences.

Session 3 was designed to build confidence and assertiveness with the horse by developing an understanding of its behavior. B and S showed great motivation to go to the horse and overcome their fear. The emotions they felt during session 2 were discussed, and they were given information about PTSD for therapeutic purposes. This session allowed them to discuss and analyze each other's symptoms.

For *session 4*, B and S came by bus without their parents.

The objectives focused on empowerment and emotional management. The session included riding bareback (without a saddle) on the horse, for a body-centered approach, sensory perceptions (movement, sounds, heat, smell), breathing, relaxation. The brother and sister helped and supported each other, were able to express their sensations and emotions, and described a feeling of pleasure and freedom.

Session 5 dealt in a didactic and therapeutic way with the neuro-psycho-physiological mechanisms of reaction to stress, the links between emotions and memory. The traumatic experience could be evoked and reprocessed during the relaxation session on the horse's back. S and B were proud of their progress and very motivated to continue.

During *session 6*, the relaxation and breathing work on the horse was continued to encourage letting go. Then the riding with saddle (first at walk, then with discovery of the trot) had for objective to exercise concentration and coordination. Finally, the horseback ride in the park led them to no longer consider the outside environment as threatening but as a source of pleasure and well-being. B and S expressed their ambivalent feelings of pleasure in the discovery of new sensations and the desire to surpass themselves, but also of fear and discomfort, linked to the feeling of imbalance when riding the horse.

Session 7 introduced the experimentation of leading the horse in longing, which implies attention, observation of the horse's movements at the three paces (walk, trot, gallop),

self-assertion through voice, posture, and gestures to control and direct the horse. The two teenagers were impressed by the horse's gallop and felt emotions of fear mixed with wonder. A time of relaxation in bareback riding followed. The outdoor ride then led to discussions and a sense of pride. B expressed her evening anxiety, S described his fear of going alone in the city, as well as his difficulties in expressing himself in public and his fear of other people's gaze.

Session 8 exercised attention, coordination, memorization through the ethological approach of the horse, opening to the perceptions and emotions of the horse. Letting go and the feeling of pleasure and well-being were obtained during the walk at the end of the session. B was happy to feel new sensations. S expressed a feeling of discomfort and imbalance when trotting and disappointment in relation to his expectations. This made it possible to work on the notion of the reality principle, coping, and the ability to overcome difficulty and adversity.

Session 9 exercised support between brother and sister, and emotional distancing. B encouraged his brother to overcome his apprehension when working with the horse on the ground. The presence of his sister was a containing and reassuring factor for S to surpass himself and manage to carry out the exercise without getting into trouble. A time of relaxation with work on breathing allowed him to relax and to verbalize his sensations.

Session 10, in the presence of the parents, revealed S's determination to trot, his ability to take initiative and to surpass himself. He was happy and valued to see that he was better able to find his balance on the horse. The two teenagers have progressed in self-assertion. They expressed their feelings and their satisfaction, which was shared by the parents.

3.2. Overall

The two teenagers were enthusiastic and impatient to go to the riding center, surprising their parents, despite their apprehension to face the outside world.

A climate of trust was established from the beginning and the complicity in the siblings was reinforced. The most spontaneous verbalizations took place most often outside, which testifies to the interest of the natural setting, more open and less directive.

Self-confidence could be worked on by each child at his or her own pace (work on the tone of voice, more assertive presence, and posture in front of the animal). The children gained autonomy, independence (from the fourth session they came alone by bus) and self-esteem.

A large part of the verbalizations concerned emotions that each child had to learn to identify, then to manage (anxiety, fear, anger, frustration...). Work was done on the feeling of insecurity, hyper vigilance, withdrawal, loss of self-esteem.

The notion of emotional control could be worked on through a physical approach with relaxation in bareback riding and breathing exercises. Work on letting go and taking pleasure refocused them on their body and its feelings, and they very often evoked sensations of calm and relief.

Daughter B felt a benefit since the end of the treatment. She described a decrease in anxiety, experiencing less stress in her day-to-day life and being able to get past moments of anxiety.

Boy S reported a benefit from equine-assisted therapy. He mentioned a few moments of anxiety during the day but found ways to calm himself down and his self-confidence was increased. He regretted that the sessions could not be continued.

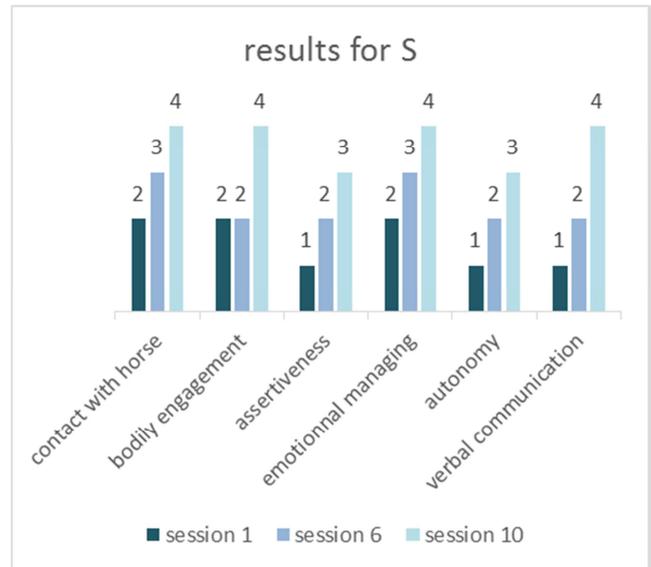


Figure 1. Quantitative evaluation of the results for the son S, during sessions 1, 6 and 10. The items of the EAT observation grid (table 1) are rated from 1 to 4 according to the observed skills.

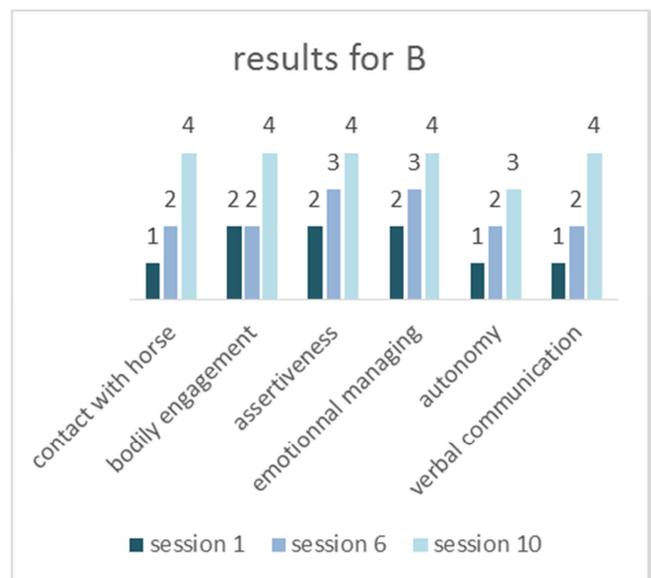


Figure 2. Quantitative evaluation of the results for the daughter B, during sessions 1, 6 and 10. The items of the EAT observation grid (table 1) are rated from 1 to 4 according to the observed skills.

All items were improved: contact with horse, bodily engagement, assertiveness, emotional managing, autonomy, verbal communication. For both adolescents, bodily engagement took much time to improve. For both adolescents, appropriate action initiatives are improving but

still insufficient.

The parents appreciated the horse therapy sessions they attended. The mother accepted to be referred to the psychotraumatology unit.

4. Discussion

For these two adolescents, as well as for their parents, the disorders persisted two and a half years after the trauma, despite immediate care by the medical-psychological emergency unit and a follow-up that was short-lived due to lack of adherence to care.

The equine-assisted therapy, although started very late after the initial trauma, facilitated the adherence to care and the therapeutic alliance, offered a containing, soothing framework and allowed to reach the objectives initially fixed: well-being, affirmation and reinforcement of self-esteem, opening to the relation to the other, acquisition of a greater autonomy, work on the separation anxiety, rediscovery of one's body and sensoriality, verbalization and management of the emotions, and control of memories. These benefits enabled these adolescents to come out of their isolation.

This case study has methodological limitations, linked on the one hand to the small number of participants, to the previous or associated care, to the absence of validated evaluation tools specific to equine assisted therapy for PTSD in children and adolescents [9], and on the other hand to the impossibility of carrying out certain evaluations because of the confinement that occurred after session 10 due to the Covid-19 pandemic. Moreover, it would have been interesting to study the medium-and-long term effects to evaluate the persistence of the benefits over time.

To be able to explain the benefits, it is important to understand how equine-assisted therapy (EAT) works in PTSD. The analysis of the factors involved must be approached from complementary angles (psycho-affective, cognitive, social, neurobiological, therapeutic) and by relating recent scientific data concerning PTSD with known data on the action of EAT. Current neuroscience research sheds light on the neuro-psycho-physiological factors involved in PTSD [2]. Intense stress leads to a biological alert reaction with activation of different endocrine and neurovegetative systems and release of stress hormones. This hyperactivity of the hypothalamic-pituitary-adrenal axis persists in PTSD, which is a maladaptive reaction, and generates different psychological and physiological consequences, maintaining the state of fear. The cognitive-emotional repercussions are manifested by cognitive dysfunctions affecting memory, attentional processes, executive functions, information processing, and by a deficit in the regulation of negative emotions and a preferential attention for negative information [1]. In neuroimaging, there are still few studies in children and adolescents suffering from post-traumatic stress disorder, but those carried out in adults have revealed changes in the brain regions involved in memory and emotional regulation. Aversive stimulation acts on the brain at the level of the amygdala, the hippocampus, and the pre-frontal cortex [3]. A

recent study by Inserm hypothesizes that the untimely resurgence of intrusive images and thoughts would be linked to a dysfunction of the brain networks involved in the control of memory and acting as regulators to stop or suppress the activity of regions associated with memories [5]. As memory is non-adaptive when it resurfaces in an inappropriate context and interferes with the subject's functioning, some current research focuses on the mechanisms of adaptive forgetting [5].

From a therapeutic point of view, the approaches are varied, but focused on the trauma. The objectives concern stress management and the reduction of neurovegetative disorders by various means including physical activity and relaxation with breath control, cognitive remediation concerning aberrant and intrusive beliefs, and memory remediation in a reassuring and empathetic context.

The known mechanisms of action of EAT have been described in numerous studies concerning the interest of equine mediation, in particular for autism [8, 11]. Several factors are involved.

Environmental factors: in equine mediation, the environment is conducive to sensory and emotional tranquility.

Factors related to the interaction with the animal: recent studies conducted at INRAE (National Research Institute for Agriculture, Food and Environment, France) have shown that equines have remarkable social and emotional recognition abilities of others (conspecifics but also humans) [19]. As a result, the horse (or pony) will adjust to the emotional state of the child or adolescent, but will also encourage emotional interactions with him/her, promote empathy and behavioral, cognitive and emotional readjustments; in equine mediation, the young person experiences his/her actions (or inactions) through the animal's reactions and the horse will act as a reinforcer of adapted and coherent behaviors [14]. Relaxation in bareback riding, combined with work on breathing, brings about a calming effect, a return to calm and muscle relaxation. A decrease in heart rate and breathing is quickly observed, the child follows the animal's breathing, which brings a state of well-being and the body can once again be a source of satisfaction and pleasure [8].

Emotional factors: being in contact with equines generates many emotions: stress, envy, excitement, impatience, joy, disappointment, fear. Working on their identification, recognizing them and assuming them allows the child to gradually control them. The mediation of the horse thus allows the child to express and regulate emotions, to develop self-confidence and self-esteem; it favors the bond and the relationship with others, develops social skills; the horse helps the child to overcome anxiety-provoking situations, to trust, to relax, to let go, to take pleasure [14]. The horse encourages a relationship, creates a bond, and allows for a different and simplified way of communicating through the eyes, the posture, and the tone of the voice.

Cognitive factors: equine mediation allows to act on the processing of information, on executive functions, and on self-awareness; activities with the horse stimulate attention, planning, memorization, organization in time and space [8].

Neurological factors: the multi-sensory stimulation provided by the horse's movement has a positive effect on the perception of the environment and on the development of adaptive strategies; the movement of the horse has an effect on posture, tone, balance, coordination, body image and brings a feeling of well-being [6, 7].

Physiological factors: the action on the neuro-vegetative system, with a decrease in stress hormones, and the release of neurotransmitters (endorphin, serotonin, oxytocin), decreases hyperarousal, promotes relaxation and emotional regulation [18].

These beneficial effects are therefore perfectly suited to the problem of PTSD. And equine-assisted therapy, in a context disconnected from the traumatic events, reassuring, motivating and valorizing, will reduce physiological hyperreactivity and hyperarousal. It improves emotional regulation and body awareness, stimulates memory control mechanisms, decenters and redirects attentional and cognitive processes towards more adapted and functional ones, and develops coping strategies.

5. Conclusion

This case study shows that equine assisted therapy for adolescents suffering from PTSD favors the therapeutic alliance and constitutes a reassuring interpersonal experience allowing the young person to manage emotions and memories, to regain self-confidence, and to be in an active process helping him to leave his victim status and to move towards resilience. Current research in the field of equine mediation as well as in that of PTSD allows to understand the mechanisms of action of this therapeutic modality.

It is necessary to pursue studies in a prospective manner, on larger samples, with complementary evaluations including medium-and-long term results, to establish evidence and validate the effectiveness of equine-assisted therapy as a complementary therapy in post-traumatic stress disorder in children and adolescents. But the methodological issues specific to the evaluation of EAT are complex [9]: financing of the sessions, need to develop adapted and sufficiently sensitive evaluation tools, material difficulties for the study of large groups, interference of external factors which are a source of variability, need to evaluate outside of the sessions but also during the sessions with the impossibility of double-blind scoring and of eliminating the subjective factor. It is envisaged to continue the research in Nice on a larger number of subjects suffering from PTSD (children, adolescents, adults), after the Nice attack or other causes, with an evaluation of the degree of PTSD using specific PTSD tools and the EAT observation grid, before the initial session (baseline), during the therapy (intermediate evaluation), at the end of the therapy (final evaluation), and then in the medium and long term. The sessions would be free of charge for the beneficiaries, thanks to associative financing.

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