
Symptoms, aetiology, epidemiology, psychophysiology, treatment, and outcomes of developmental trauma

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Developmental trauma disorder (DTD) is not a formally recognised as a diagnosis in the current diagnostic systems. There has been a push for its inclusion by child psychiatrists and psychologists within the past decade. There are a multitude of symptoms associated with DTD, which can manifest differently depending on the individual and the type of trauma they have experienced. The array of symptoms participants have reported in studies shows the difficulty in pinpointing exactly what individuals who have developmental trauma will experience throughout their lives. Based on previous works, a traumatic home environment is the most likely cause of DTD. Factors that may moderate developmental trauma disorder are discussed. Those at risk for DTD include: (i) children who have been separated from a parent; (ii) children who have experienced any form of maltreatment; and, (iii) people who, as infants, felt vulnerable and perceived their caregiver(s) as unpredictable. Exposure to trauma affects the entire body and trauma experienced in childhood is the most detrimental because the brain is still developing. Due to the nature of how varied and complex developmental trauma can be for each person, there is no single treatment that has been found through research that can cure developmental trauma. Pharmacological, psychosocial, and behavioural treatments are discussed.

Keywords: childhood, child psychology, developmental trauma, diagnosis, trauma disorder

BACKGROUND

As the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM–5; American Psychiatric Association, 2013) was being revised, a group of child psychiatrists and psychologists who belong to the National Child Traumatic Stress Network worked on gathering research and building a case for a new disorder called developmental trauma disorder (DTD). Psychiatrist Bessel van der Kolk, one of the group's co-leaders, was the first to propose the disorder in 2005 (DeAngelis, 2007; van der Kolk, 2005). As is now known, the diagnosis was now included in the DSM–5 (APA, 2013). The current diagnostic systems, such as the *DSM–5* and *ICD–10*, do not include theories about the aetiology of mental health disorders; thus, those against a form DTD diagnosis have argued that its diagnostic criteria would 'weaken the strength of existing diagnostic systems', as there is a lot of emphasis on the aetiology of DTD (Schmid, Petermann, & Fegert, 2013).

On the other hand, Bremness and Polzin (2014) have argued that the field must adopt a new diagnostic model. Carrey's study (as cited in Bremness & Polzin, 2014) stated that 'developmental psychopathology, attachment theory, neuropsychology and plasticity, as well as resiliency factors' should be taken into account when diagnosing children. Trauma impacts the developmental course of adults and children differently; when carers subject children to ongoing trauma across several developmental stages, the impact is significantly greater and presents in more developmental domains than in adults (Bremness & Polzin, 2014). Furthermore, van der Kolk (2017) has argued that DTD differs from post-traumatic stress disorder (PTSD), depression, attention deficit hyperactivity disorder (ADHD), oppositional defiant disorder (ODD), reactive attachment disorder, separation anxiety disorder, bipolar disorder, dissociative disorders, and personality disorders – but often co-exist with several of them.

Despite the lack of a formal diagnosis, the field has generated quite a bit of research on developmental trauma. This paper addresses the symptoms, aetiology, epidemiology, psychophysiology, and treatments and treatment outcomes of developmental trauma. The paper concludes with a call for the inclusion of DTD in diagnostic systems, as well as more studies on treatments specifically for DTD

Symptoms

Developmental trauma has symptoms that can manifest differently depending on the individual and the type of trauma they have experienced. Stolbach et al. (2013) stated that the criteria for DTD takes into account the chronicity of exposure, the caregiving environment for the individual affected, and the key symptoms that seem to co-occur within those who are exposed to the trauma. There are a multitude of symptoms associated with developmental trauma.

Kisiel et al. (2013) sorted developmental trauma into four categories: violent, non-violent, both violent and non-violent, and other trauma. Their study also sorted the symptoms associated with developmental trauma into five categories: affective and physiological dysregulation, attentional and behavioural dysregulation, self and relational regulation, post-traumatic spectrum symptoms, and functional impairment. The last two categories are an addition to the first three, which were also discussed in the work of Stolbach et al. (2013).

Some of the symptoms associated with affective and physiological affect dysregulation include anger control, regulatory problems, and sensory/motor issue. Attentional and behavioural dysregulation symptoms include social behaviour, judgement, and self-harm behaviours. Self and relational dysregulation symptoms are related to well-being, attachment, and interpersonal strengths. Post-traumatic spectrum symptoms include avoidance, numbing, and dissociation. The functional impairment includes symptoms related to school behaviour, family functioning, and legal issues (Kisiel

et al., 2013). The individuals who reported the highest percentage of these symptoms fit into violent and non-violent category of trauma.

The self-reports of the participants in the studies conducted by Kisiel et al. (2013) and Stolbach et al. (2013) showed that individual experiences of developmental trauma can vary greatly. The individuals affected by the disorder reported a variety of symptoms that ranged from lack of anger control and lapses in judgement, which caused legal issues, to a decreased sense of well-being due to issues with self-harm behaviours and a lack of appropriate social behaviour (which was related to difficulties in having lasting relationships). The array of symptoms the participants reported in the studies shows the difficulty in pinpointing exactly what individuals who have developmental trauma will experience throughout their lives.

The large range of symptoms associated with developmental trauma leads to an individual being diagnosed with a multitude of different disorders in the *DSM-5* (APA, 2013). As previously mentioned, the APA does not have a specific diagnosis in the *DSM-5* for developmental trauma. The category of trauma and stressor-related disorders in the *DSM-5* covers diagnoses that can result from trauma which they have experienced, as well as the specific symptoms needed to make the different diagnoses.

It is a shortcoming of the *DSM-5* to not specifically include a DTD diagnosis. The lack of an appropriate diagnosis causes individuals with developmental trauma to be diagnosed with multiple disorders to sufficiently cover their symptoms. Stolbach et al. (2013) reported less than 25% of children receiving services from the National Child Traumatic Stress Network have symptoms that meet the criteria for PTSD in the *DSM-5*. This information illustrates how individuals who have experienced developmental trauma are not being given a trauma-specific diagnosis. If they were to receive a trauma-specific diagnosis, individuals could potentially receive more specifically targeted treatments related directly to the trauma they have experienced.

The difficulty in giving diagnosis of DTD is also related to the *DSM-5*'s lack of brain-based scientifically valid systems. The *DSM-5* uses symptom reporting to diagnose. Insel (2013) called for a more diagnostic tool that takes into account biological markers, rather than just symptom-based diagnosis. The National Institute of Mental Health (NIMH) is developing the Research Domain Criteria (RDoC). The aim of the RDoC is to incorporate genetics, imaging, cognitive science, and other levels of information to lay the foundation for a new classification system (Insel, 2013). This type of diagnostic tool would allow professionals to use testing as a way to diagnose developmental trauma and streamline the diagnostic process to include more than just the symptoms the individual is reporting. This would allow for a person to receive one diagnosis of DTD, rather than having these individuals receive multiple diagnoses from the *DSM-5*.

The difficulty in supporting a diagnosis of DTD is attributed to the wide variety of symptoms the individual is experiencing and the lack of specific diagnosis. Findings from Kisiel et al. (2013) and Stolbach et al. (2013) relied on the self-report of the participants and both articles stated the same limitation: They used diagnostic tools that were not made to specifically diagnosed DTD. The symptoms that the individuals described varied. This variation in symptomatology showed how two individuals given the same diagnosis of DTD could have drastically different course of the disorder. It is important for professionals in the mental health field to consider diagnosis of DTD for individuals who have any variation of the symptoms mentioned previously.

Aetiology

The aetiology of DTD consists mainly of 'multiple exposures to interpersonal trauma, such as abandonment, betrayal, physical or sexual assaults or witnessing domestic violence', according to van

der Kolk (2017). Trauma can be thought of as belonging to one of two types of categories. Schmid, Petermann, and Fegert (2013) classify Type I traumas as singular events that happen in public. Some examples include experiencing the destruction of a home by hurricane or tornado with the family members inside or witnessing the death of a friend in combat. They classify Type II traumas as repeated events over a long period of time and usually in the privacy of the home. Some examples include witnessing a mother battered over years, experiencing repeated rape by an uncle, or chronic neglect as a child. According to Ma and Li (2014), when children experience Type II traumas, the stress response systems are activated repeatedly over the course of years. Therefore, DTD differs from PTSD; whereas PTSD may occur as a result of a single event, DTD arises from exposure to chronic, ongoing traumas in childhood and the subsequent effects of developing brain. While Type II traumas are considered most likely to cause PTSD, Type I traumas are considered most likely to cause DTD.

In studies of rats, mothers that licked the babies more often (a behaviour that is considered an expression of maternal care) has lower levels of oxidative stress and DNA damage compared with the babies of rat mothers who licked less often, according to De Moura, Porawski, and Giovenardi (2017). Another study done in 2013 by Allam et al. (as cited by De Moura et al., 2017) found evidence that when rats had oxidative stress chemically induced, similar behavioural changes occurred such as those that would be expected if experiencing stress in the natural environments. Anxiety and reduction in memory and learning function were present after the stress induction. However, using antioxidant could prevent these issues. The conclusion of this study is that oxidative stress causes these behavioural changes. In 2013, Patki et al. (as cited by De Moura et al., 2017) also found that oxidative stress impacts critical brain functions. Poor mental care in rat studies has been linked with an increase in oxidative stress. However, the connection is not conclusive, since it could also be that increased levels of oxidative stress in rat babies causes changes in rat mother behaviour. Nevertheless, while not completely conclusive, it is likely in humans that chronic stress caused by neglect, domestic violence exposure, sexual abuse, and other forms of maltreatment will have a direct impact on important brain systems related to memory, cognition, and more.

In DTD, the stress response systems are chronically agitated by the exposure to the maltreatment and the subsequent dysregulation in the following areas: affective, somatic, behavioural, cognitive, relational, and self-attribution. Van der Kolk (2017) stated that some specific responses including, clinging, self-hate, cutting, depersonalisation, distrust, and self-blame. Van der Kolk (2017) also emphasised that the crisis of chronic exposure to traumatic events affects children in significantly different way than adults, because children are not able to remove themselves from the environment and are also dependent upon the perpetrators of the trauma. There are clinically significant differences in the adaptation strategies that children use, compared to adults, such as those mentioned previously. Therefore, a traumatic home environment is the most likely cause of DTD.

Some factors may moderate developmental trauma disorder. Research on resilience by Bradley, Davis, Wingo, Mercer, and Ressler (2013) found that positive factors in children's family environment were associated with higher levels of resilience and less psychopathology in adulthood. Research on resilience has also shown that some cultures and environments are more resilient than others. Southwick, Bonanno, Masten, Panter-Brick, and Yehuda (2014) found that people respond to stress differently depending upon cultural, religious, and community contexts are more resilient than others. The problem, then, with DTD, is that the source of potential resilience is the actual source of trauma. No current studies have examined resilience as a moderating factor of DTD, but perhaps positive influences from extended family, peers, school, or other environments could moderate the negative outcomes associated with DTD as they have been shown to in studies related to childhood trauma.

As DTD is still not included in the *DSM-5*, there has yet to be research that has found detailed results concerning genetic risk factors. However, because DTD research is likely to have correlates to research

on PTSD, research may discover similar genetic risk factors. That being said, according to Schmid, Petermann, and Fegert (2013), psychosocial factors are heavily relied upon when diagnosing DTD to the exclusion of genetic and biological factors. The authors also stated that repeated trauma is essential when diagnosing DTD. However, they are also critical of the monocausal (psychosocial) stance of DTD. They emphasise that other origins must be ruled out including neurobiology, epigenetics, and transgenerational traumas.

One aspect of tying DTD to what has been called Type II traumas that raises questions is whether or not there is a difference between the effects of chronic public wartime traumas on children and the effects of Type II traumas experienced at home. Is there a qualitative or quantitative difference between chronic traumas experienced by children by caretakers versus those experienced as child soldiers, for example? Those wanting to create a separate diagnosis of DTD from PTSD, and using the two categories of trauma as one of the main pieces of evidence, have a greater burden to produce research that shows that the effects of chronic Type I traumas experienced by child soldiers, for example, are clinically and diagnostically different than the effect of chronic Type II traumas experienced by children in other contexts. It is also unclear if chronic private abuse in the form of bullying can result in DTD, particularly because bullying can be perpetrated by peers at school, but also by siblings in a home environment. In other words, is the psychosocial aetiology of DTD tied to parents and caretakers, or can the psychosocial aetiology of DTD come from other places, such as an abusive priest or chronic bullying?

Epidemiology

Lang and Connell (2017) found that in the US, 71% of all children are exposed to at least one potentially traumatic event (PTE), including sexual abuse, physical abuse, and domestic community violence. Rojas-Flores, Clements, Hwang Koo, and London (2017) examined the intersection of parental immigration status and US-born Latino children's mental health following parental deportation or detention. After controlling for trauma history, they found that children with a deported parent had more internalising problems than did children of detained or deported parents experienced more psychological distress and trauma and their parents rate them higher in PTSD symptoms than the children of parents with legal citizenship. Interestingly, Arditti and Savla (2017) found that parental incarceration may be a unique predictor of child trauma in single caregiver homes, regardless of minority status. It seems that parent-child separation can have a negative effect on a child's development. Perhaps there is a difference between an unexpected incarceration and the looming potential threat of separation that an immigrant child might experience.

Turner et al. (2012) found a strong link between early exposure to stressful events and conditions and damage to neurological, physiologic, and psychosocial systems. Young children may be especially vulnerable to this. In this study all forms of maltreatment – including physical, emotional, sexual, and neglect – significantly influenced child development. The culture of the family exacerbated the effects of the maltreatment. Some of the characteristics were stress, instability, turmoil, overt family conflict and anger, deficient nurturing, and unresponsive or unsupportive parenting. Their research found that alcohol or drug problems were related to several forms of family-perpetrated victimisation, especially witnessing family violence and child neglect. Residence instability (living in multiple homes) was highly related to child neglect. There were also strong associations between trauma symptoms and inconsistent and hostile parenting, emotional maltreatment, witnessing family violence, and parental conflict. Fusco, Jung, and Newhill (2016) found that children of parents who have experienced trauma have a higher prevalence of lifetime trauma symptoms. In addition, they found that the third generation of Holocaust survivors reported more psychosocial problems than the comparison group.

One population at risk of DTD includes people who, as infants, felt vulnerable and perceived their caregiver(s) as unpredictable. The Minnesota Longitudinal Study of Risk and Adaptation was a study of

180 children and their families from birth to nearly age 30. They found that having vulnerable and unpredictable parent-child relationship was the most predictive of adolescent behavioural problems. Interestingly, none of the following were predictive of adolescent behavioural problems: the mother's personality, the infant's neurological anomalies at birth, IQ, and temperament. What was significant was how the parents felt about and interacted with their children. When parents could not help the child develop the ability to do so, it led to development problems. Children who were often pushed over the edge into hyper-arousal and disorganisation did not develop a healthy attunement of their inhibitory and excitatory brain systems and grew up anticipating that they would lose control if they were upset. This set up a vicious cycle often leading to more disruptive and aggressive behaviour throughout the child's development (van der Kolk, 2014, p. 162).

Another population at risk for DTD is children who were victims of sexual abuse. In 1996, Frank Putnam and Penelope Trickett did a longitudinal study on the impact of sexual abuse on female development. They recruited 84 girls who were referred by the District of Columbia Department of Social Services and had a history of sexual abuse by a family member. The results found that compared to girls of the same age, race, and social circumstances, sexually abused girls showed more cognitive deficits, depression, dissociative symptoms, troubled sexual development, obesity, major illnesses, higher high school dropout rates, and self-mutilation. The researchers also found that the abused girls had an earlier onset of puberty – about 18 months earlier than the non-abused girls – as sexual abuse sped up their biological clocks and the secretion of sex hormones. The abused girls also showed a decrease in cortisol when dealing with stressful events over time, suggesting that the girl's bodies were adjusting to chronic trauma by way of an overall numbing (van der Kolk, 2014, p. 163).

None of the associations with childhood trauma are categorically surprising. It is interesting to consider the reports about the negative effects of parent-child separation – it prompts one to think about the difficult decisions that families and social workers have to make regarding when it is less traumatic to separate the child from the parent when the parenting is in a grey area as far as the 'damage' being done. One question the writers still have is whether or not age factors into this as far as the developing brain goes. Is it more of a consideration to remove a one-year-old from the home of a parent who is doing a poor job than if the child is 16 year old?

Psychophysiology

Exposure to trauma affects the entire body. When an individual is exposed to repeated traumas, especially in childhood, they most often develop complex symptoms. These symptoms can present as anxiety, anger management issues, aggressive or socially avoidant behaviours, and self-regulatory behaviours (van der Kolk, 1988).

When an individual experiences a threat, their brain is automatically triggered to put the body into an escape mode. First, the eyes and ears confront the information. Then, the information is then sent to the amygdalae, where the information is interpreted. If danger is perceived, then distress signals are sent to the hypothalamus, which activates the sympathetic nervous system. From there, signals are sent to the adrenal glands to secrete the stress hormones adrenaline and cortisol, which engage the sympathetic nervous system, which then prepares the body for 'fight or flight' (Rodrigues, Ledoux, & Sapolsky, 2009). When the body experiences this stress response there are a few changes that the body undergoes. Some changes included increased heart rate, heightened blood pressure, blood is pumped to muscle and vital organs, small airways in the lungs open wide so more oxygen can be inhaled with each breath, increased alertness to the brain, senses become sharper, and epinephrine is released – which then releases blood sugar so fats can be stored temporarily (Harvard Publishing, 2016). When the individual is no longer in danger, the brain and the body recover and return to an equilibrium (van der Kolk, 2015, p.54).

Although this system is meant to protect humans, it can also be a hindrance. If a person is being blocked from the ability to escape the threatening situation, such as if an individual were being held down, trapped, or unable to act to escape, their body continues to stay in 'fight', 'flight', or, as van der Kolk (2015, p.54) proposes, 'freeze' mode. Because the person is unable to escape the danger and come back to equilibrium, both amygdalae continuously send signals to the adrenal glands to continue secreting the stress hormones that keep the brain and body firing as if they had never escaped the threat. When this happens, even though the event has passed, the brain continues to send signals to prompt the body to escape a threat that is no longer present (van der Kolk, 2015, p.54). Studies suggest that children who have post-traumatic stress symptoms have higher levels of cortisol than children who have no trauma history (Carrion & Wong, 2012). After reviewing fMRI scans, it was suggested that there is an increased response in both amygdalae and hippocampi in those who had experienced early chronic trauma, which may possibly have altered their neurochemistry (Maheu et al., 2010). A study on animal research by De Bellis (2001) found that the animals exposed to repeated trauma or abuse had an impact on the neurochemistry, which led to activation releasing of corticotrophin, which resulted in animal behaviours that are consistent with anxiety, hyperarousal, and hypervigilance – which are common symptoms of PTSD.

Trauma experienced in childhood is the most detrimental because the brain is still developing. When a baby is born, the most primitive part of the brain, the brainstem, is already working. The brainstem regulates eating, sleeping, wakefulness, crying, breathing, hunger, wetness, pain, and ridding the body of toxins through urinating and defecating. These functions are so fundamental even through old age (Pilao, Relajo, Tubon, & Subida, 2016) – and because these functions are so fundamental, they are also the first to be neglected when a child experiences trauma, hence why some children experience sleep disturbances, bowel problems, extreme hunger, or, for many children, wanting to scream when someone touches them (van der Kolk, 2015, p.56). McGee (2000) found that the children of the mothers who had been exposed to trauma had experienced health problems such as asthma, eczema, eating problems, headaches, stomach pains, and sleep problems. With the knowledge of how trauma can affect the body, it is imperative that medical providers recognise these symptoms and not overlook the possibility that these symptoms could be related to having a history of trauma.

After the brainstem, the limbic system is the next part of the brain to develop. The limbic system regulates emotions, monitors dangers, judges what is scary and what is pleasurable, and monitors our survival instincts. The experiences that a baby goes through contribute to make the 'emotional and perceptual' map of the world for the individual. In terms of trauma, when a person is in a constant state of fear, the neurons in the brain make that connection and become specialised in managing the feelings of fear and abandonment (van der Kolk, 2015, p.57).

McGee (2000) suggested that children who witness the violence that was committed against their mothers had the most common emotion of fear. The researcher also found that many of those children also feared men and, overall, reported feelings of sadness, anger, and powerlessness. Because the limbic system is the part of the brain that regulates emotions, it can be concluded that repeated violent experiences make neuronal connections in the brain that increase the chances that an individual is in a constant state of fear, anger, sadness, and powerlessness.

TREATMENT AND OUTCOMES

Due to the nature of how varied and complex developmental trauma can be for each person, there is no 'one single treatment' that has been found through research that can cure this type of trauma. However, when looking at developmental trauma, disorders that stemmed from this experience were PTSD, ODD, and anxiety and phobic disorders. Purvis, McKenzie, Razuri, Cross, and Buckwalter (2014) noted that developmental trauma can even cause negative alterations and deficits in a person's brain structure,

and this change in the brain also can change how it functions, and can lead to negative health problems down the line for an individual. That being said, when looking at treatment options for someone who is experiencing developmental trauma, it could be beneficial for the client to be looked at with more of a holistic lens, meaning looking at what symptoms the client is experiencing as well as other diagnoses the client might be dealing with.

Pharmacological

When looking at pharmacological treatments, Gorman et al. (2015) looked at developing evidence-based guidelines in drug treatments when psychosocial interventions were not working to treat children with ADHD, ODD, and conduct disorder. In the study, the researchers found that the medication known as Valproate, when used at a dosage of anywhere between 750–1500 mg/day, seemed to be effective in controlling extreme aggression in children and adolescents. However, more research on this drug needs to be done as the sample of the study was only with 50 participants and the drug poses a risk of causing polycystic ovarian syndrome in females.

Kamo et al. (2016) looked at the effectiveness of the drug Sertraline for the treatment of PTSD among 122 Japanese patients. The dosage given to patients range from 12.5 to 150 mg/day and the drug was given to patients for a median of 10.6 months. The clinician who diagnosed the patients with PTSD assessed the effectiveness of the drug by using the Clinical Global Impressions-Severity (CGI-S) and Clinical Global Impressions-Improvement (CG-I) ratings. Results of this study showed that two-thirds of patients improved in their severity of PTSD with this drug treatment (65.6%). The remaining patients either showed no improvement (32.8%) or worsened (1.6%) when they used this drug to treat PTSD. Of the 122 participants used in this study, 119 participants were females and three were males. The use of the antidepressant Sertraline does have some negative complications attached to it. A study done by Gentile (2005) looked at the effects of different antidepressants on pregnancy and breastfeeding. The researcher found that Sertraline seemed to be associated with non-normal findings in babies specifically that of poor adaptation, abnormalities in white blood cell count, and even reduced pain response.

Nutrition can also play a role in the treatment of developmental trauma. In a study looking specifically at nutritional programmes to treat burnout, resiliency, and PTSD among individuals in the military, Zodikoy (2014) had 17 participants complete the Maslach Burnout Inventory (MBI) questionnaire as well as a health questionnaire. The researcher also collected urine and saliva samples from each participant before the study began in order to measure a variety of aspects such as neurotransmitters, cortisol levels, and melatonin. After the urine and saliva results were analysed, each person was given an individual nutritional supplementation programme, consisting of vitamins, herbs, and amino acids based on their individual test results. Participants were also encouraged to not make any lifestyle changes. After 90 days, participants were tested again and showed a 41% improvement on the MBI. Before the 90 days, the mean on the MBI was -13.13 with the standard deviation (SD) at 13.34 . After the 90 days, however, the mean was 0.88 and the SD was 11.03 .

Peet and Stokes (2005) looked at the benefits of using fish oil in the treatment of psychiatric disorders. One finding was that using 1g a day of Eicosapentaenoic Acid (EPA), along with antidepressant medication, showed an improvement in depressive symptoms. However, the authors made note of possible side effects of fish oil use, including nausea, runny stool, and a fishy taste when burping. Because individuals who suffer from developmental trauma may be at high risk for having depression or already have depression, the use of fish oil could be beneficial for this population. However, more research needs to be done specifically with individuals who have undergone extensive trauma to see if fish oil is beneficial in the long run.

Psychosocial and behavioural

Black, Woodworth, Tremblay, and Carpenter (2012) found that when looking at behavioural treatments that can help with developmental trauma, trauma-focused cognitive behavioural therapy (TF-CBT) could be beneficial. This type of therapy can be used with both males and females and the aim is to reduce negative symptoms an individual may face (e.g., depression, PTSD, etc.) by mastering the stress that is brought on by traumatic memories.

Purvis et al. (2014) looked at using Trust-Based Relational Intervention (TBRI) for complex developmental trauma on a 16-year-old female who lived in a residential treatment centre. The female, Rachel, had a history of abuse and neglect. She was considered a 'difficult' client to work with in the treatment centre and she did not respond well to other treatments offered at the centre. TBRI was implemented with Rachel in three phases. Phase 1 was focused on Rachel building skills needed for healthy communication and relationships with others. Phase 2 was focused on having Rachel focus on skills related to self-regulation and achieving small goals. Phase 3 was about keeping the skills learned in Phases 1 and 2 but also being able to return to the practices at the treatment centre where Rachel was living. Results of this intervention were positive. The researchers noted that ten months prior to beginning TBRI, Rachel had a total of 63 restraints and 60 seclusions (6.3 restraints and 6.0 seclusions per month). After the intervention was complete six months later, Rachel had only 15 restraints and 13 seclusions (2.5 restraints and 2.2 seclusions per month). Rachel also had an overall increase of serotonin.

There does not seem to be many studies regarding information on the effects of progressive muscle relaxation related to developmental trauma; however, trauma can come in different forms and stem from different experiences a person goes through. A study done by Tsitsi, Charalambous, Papastavrou, and Raftopoulous (2017) looked at the use of progressive muscle relaxation and guided imagery techniques on parents who had a child diagnosed with a form of cancer. The study consisted of 54 participants, 29 of which were in the intervention group and the other 25 participants were in the control group. Various questionnaires were given to participants in order to collect data and results seem promising, although more studies should be done as the sample size was very small in this study. Overall, parents in the intervention group felt less stressed and less anxiety after engaging in the progressive muscle relaxation and guided imagery techniques.

Specialised training in self-regulation can be helpful in the treatment of DTD. Graviano and Hart (2016) state that self-regulation refers to the process, planning, direction, and control of an individual's functional domains. These domains include emotion, behaviours, cognitions, and actions that are necessary for functioning at an optimal level. Children who have behavioural issues that are related to trauma are more likely to have difficulties in these domains compared to children who have not experienced trauma or are typically developing (Graviano & Hart, 2016). Self-regulation is typically acquired through social learning during development. The child models the behaviour and the caregiver reinforces it (Ford & Blaustein, 2013). When the child grows up with severe neglect or trauma, they miss out on these learning opportunities.

Training in self-regulation can provide the individual's affected by trauma with guidance by teaching the basic concepts and skills, coaching and facilitating skills, and enhancing the individual's motivation and trust to learn these skills (Ford & Blaustein, 2013). In a group of 45 preschool age children, those who were given self-regulation training, along with parent training showed improvement in academic functioning (i.e., cognition), as well as improvements in social, emotional, and behavioural domains (Graviano & Hart, 2016). Self-regulation training can also be helpful in juvenile detention centres. Ford and Blaustein (2013) found that when a staff member set an example that encourages the juvenile's self-regulation, the juvenile is more likely to be mindful in their reaction to stressful events that they may

have overreacted to in the past. Self-regulation training can be helpful to those affected by DTD when done with a trusted caregiver or professional.

Efficacy for the use of neurofeedback in the treatment of trauma is growing. A study by Gapen et al (2016) on the use of neurofeedback found that after 40 neurofeedback treatments, 17 participants who completed the treatments had an average of a 20-point reduction (69.14 to 49.26) in the Davidson Trauma Scale. The groups were randomised to assess the treatments at either the T4–P4 location or the T3–T4 location, with no statistically significant difference in reduction between the two sites. While the study was assessing trauma in the context of PTSD, all of the participants who completed treatment had onset of PTSD prior to age 18, when DTD occurs. The types of trauma included childhood abuse of various types: emotional, physical, and sexual. While neurofeedback did not completely eliminate the trauma, there was a large reduction in symptoms. The study was a pilot and the results may be considered a starting point for future research on the use of neurofeedback for treating childhood trauma.

There are no published studies investigating heart rate variability (HRV) biofeedback as a treatment for people with DTD. However, there are studies that have explored the efficacy of it for patients with PTSD, the results of which could possibly generalise to DTD populations. The research on HRV biofeedback suggests that it plays a role in reducing the anxiety and depression related to PTSD. People with PTSD have heightened arousal, which often leads to an increased heart rate, or more specifically, a change in HRV (Lande, Williams, Francis, Gragnani, & Morin, 2010).

Lande et al. (2010) conducted a pilot study on the efficacy of HRV biofeedback for 39 PTSD patients. Approximately half of them were assigned to the control group. The main outcome measures were the Zung Self-Rating Depression Scale and the PTSD Checklist Military Version. The results were not significant, indicating that the biofeedback did not improve scores. However, the participants reported great satisfaction with the technique, which many found to be relaxing.

Tan, Dao, Farmer, Sutherland, and Gevirtz (2011) compared baseline HRV in patients without PTSD and combat PTSD veterans, evaluated the efficacy of HRV biofeedback on PTSD symptoms, and looked at the practicability of HRV biofeedback as a treatment for PTSD symptoms. The participants included 20 veterans with PTSD (half assigned to a control group) and 10 people without PTSD or other psychiatric disorders. The researchers used the Clinician-Administered PTSD Scale and the PTSD Checklist-Specific, which were used to assess symptoms in all 30 participants. They found that the PTSD veterans had significantly lower HRV compared to the control group and that biofeedback is both feasible and acceptable as a treatment for PTSD. Furthermore, they found that PTSD symptoms were significantly reduced in the experimental group (who received biofeedback and treatment as usual (TAU)) but not the control group (who received TAU only). However, there was not a significant difference in PTSD symptom reduction between the two groups, which the authors assumed might be related to the small sample size.

With neuroscience, it has been confirmed that the part of the brain that is affected by trauma is the midbrain and the lower brain, which are responsible for emotions and survival skills (van der Kolk, 2014). Because of such, reason and logic are impacted which makes it difficult to make sense of what happened; therefore, regular talk therapy may not be as helpful (van der Kolk, 2014). Through the use of art therapy, children are able to access sensations and memories that might not otherwise be accessed through talk therapy. Research has found that, through art activities, there is a reduction of hyperarousal by engaging the body's relaxation response (parasympathetic nervous system), which can provide the child with a way to manage hyperarousal sensations (Steele & Kuban, 2013). Along with engaging the body's relaxation response, using art therapy has also shown to reduce autonomic responses such as, high blood pressure, heart rate, and respiration (Malchiodi & Crenshaw, 2013). One

example of an arts-based programme that was developed by Coholic (2010) to treat traumatised children aimed to increase self-awareness and resilience using art to teach children to become aware of their feelings in a non-judgmental way. The interventions resulted in the children having improved coping skills and self-regulation (Macpherson, Hart, & Heaver, 2012). Art therapy has the ability to reach traumatised children in a way that talk therapy may not be able to.

Drawing as a form of art therapy seems to also be a helpful method when dealing with developmental trauma. Steele (2009) notes that trauma memories are stored as images in a person's brain, as the experience of trauma is a sensory experience rather than simply a cognitive experience. When a person is able to draw out his or her experiences, it provides the clinician the ability to perceive the experience the way the client sees it and thinks about it. By getting the clients perspective on the situation, this could make treatment planning more personal and hopefully more beneficial to the client.

Mills and Turnbull (2004) detail how functions of the mind that spoil intimacy will exacerbate the general effects of trauma for the individual. Secondary stressors play a large role in the development of a trauma reaction, which can progress over time. Intimacy is a characteristic of functioning that can influence the initial impact and eventual meaning assigned to a traumatic event. It can also impact the pattern of processing after the impact of the trauma. Interest in sexual intimacy may increase or decrease after a sexualised trauma. This depends on the strategy of the individual to either avoid reliving the experience or attempt to repair or counter the bad experience with a good one. Regarding treatment, the aims of a trauma couples therapist should include co-creating a safe and contained environment where the couple can share thoughts and feelings honestly and openly. Dysfunctional patterns and cognitive distortions should be systematically identified and eliminated. It can be helpful for the therapist to include playfulness, spontaneity, and relaxation to help ease the process along. It is important that the therapist follow-up assessment sessions with psycho-education, in order to help normalise the trauma symptoms.

CONCLUSION

DTD is a complex disorder that is still being debated for inclusion in the current diagnostic systems. Proponents of a formal diagnosis believe that the current trauma (and other related) diagnoses do not fully encapsulate the experience of ongoing, interpersonal trauma in childhood. Opponents of the inclusion of DTD as a diagnosis warn that such a diagnosis will weaken the strength of the current diagnostic systems because they do not rely on aetiology, which is a major part of the diagnosis of DTD. The symptoms of DTD vary greatly depending on the individual. The large range of symptoms associated with developmental trauma leads to an individual being diagnosed with a multitude of different disorders in the *DSM-5*, which supports the need for a single diagnosis that encompasses the varying presentations of the disorder. The aetiology of DTD can be boiled down to ongoing interpersonal traumas experienced in childhood. Those at risk for DTD include children who are separated from a parent, children who experience maltreatment, and people who felt vulnerable as infants and perceived their caregiver(s) to be unpredictable.

Developmental trauma affects the body's normal psychophysiological processes and can be very detrimental to a child's developing brain. Although there have not been studies on pharmacological treatments specifically for DTD, there has been success with certain drugs and supplements for related disorders. Case studies on TF-CBT, TBRI, self-regulation training, and art therapy/drawing as treatments for developmental trauma were shown to be helpful. Although there are several treatments that appear promising for trauma, there should to be more studies done on a large-scale and specifically among patients that exhibit symptoms of DTD.

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