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9 IN VIVO EXPOSURE AND NEUROSCIENCE

In vivo exposure in prolonged exposure (PE) is a core component and a primary part of recovery. Through in vivo exposures, patients begin to take their lives back from posttraumatic stress disorder (PTSD), as they approach rather than avoid the people, places, and situations that are associated with their trauma. Thinking back to Chapters 1 and 2 of this book and with reference to the PE manual (Foa, Hembree, et al., 2019), the hierarchy for in vivo exposure may include items that are associated with the trauma and provoke negative affective responses, as well as items that may be associated with behavioral activation whose goal is to reconnect with the world and community. In this chapter, we focus on how to make neuroscience-informed decisions in practice when using in vivo exposure to optimize patient outcomes that are based on what we know about how PE works in the brain and the body.

NEUROSCIENCE APPLIED TO HIERARCHY PLANNING

Choosing which items to include on a hierarchy is critical to the success and impact of PE. A therapist who is not effective in building a powerful hierarchy with a patient will be less effective in reducing PTSD. As noted above, in vivo

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exposure is the tool that most specifically gets patients back doing the things that they want to do in life. The most effective PE therapists begin with the end goal in mind, which means that they are including items on the hierarchy with consideration of the goal for each planned individual exposure exercise. For each hierarchy item, therapists should consider two questions: What is the core fear that the item is addressing? What specific learning does the patient need to get from this in vivo item? To illustrate, driving in heavy traffic is an item on many combat PTSD hierarchies. However, an effective therapist who is using neuroscience to inform PE practice is considering the specifics of this in vivo scenario in detail. If the core fear is that the patient would be trapped and unable to escape, the specific variations on this item would be different than if the core fear is that potholes cannot be seen in traffic and represent an urgent threat. Variations for the first core fear would include ensuring that the patient has varying levels of being surrounded by traffic (feeling more or less trapped). The second situation would involve varying the likelihood of encountering potholes. The most effective hierarchies are made up of items (a) where the patients can see and feel the impact on their daily functioning and quality of life, (b) that increase social connection and reduce isolation, (c) that include variations to allow for specific experiences of generalization, and (d) that allow systematic repetition of the core fear/negative affect outcome.

Unpacking each of these items and connecting to the core neuroscience findings reviewed in Part I of this book, we begin with the concept of preferentially including those items where patients can see and feel the impact on their daily function and quality of life. The obvious reason for this is that people come to treatment to address a problem (e.g., I cannot attend my child's sporting events; I cannot enjoy sexual relations with my partner). When providers can make changes that address the presenting problem, patients experience increased motivation, hope for additional positive changes, and so forth. These changes are reflected in lower symptoms, more confidence, and more positive thoughts about themselves and the world (e.g., Foa & Rauch, 2004; Kumpula et al., 2017; McLean, Yeh, et al., 2015; McLean et al., 2019; Zalta et al., 2014), as well as in changes in body responses, such as heart racing or sweating (e.g., Maples-Keller, Rauch, et al., 2019; S. A. M. Rauch, King, et al., 2015). Indeed, we would expect that as patients experience mastery in situations that they previously avoided because of their association with trauma, these bodily changes and self-perceptions create a positive change feedback loop that can increase outcomes and motivation to continue to work hard in treatment. As patients do the things they want to do, they are happier, healthier, and farther along in recovery.

Why does neuroscience suggest that we include items that enhance social connection and reduce social isolation? Research supports the beneficial impact of positive social connection on mood possibly through oxytocin (Donadon et al., 2018). Whereas results of augmentation studies of PE with oxytocin have been mixed with a current trial ongoing, the psychotherapy literature suggests that social support is one of the most reliable predictors of positive treatment response (Dour et al., 2014; Price et al., 2013). In addition, connection to family, community, and loved ones provides buffering from relapse, as well as motivation for new life goals and meaning (S. A. M. Rauch, Yasinski, et al., 2020). Thus, therapists can encourage specific opportunities for prosocial connections during PE that would likely increase the release of oxytocin through incorporation of items in the in vivo hierarchy that involve social interactions with family, friends, and community. For instance, PE therapists may encourage a patient who experienced combat trauma to approach military memorabilia and join a veteran organization where such materials are displayed. This would address both extinction to the activation associated with military memorabilia and allow for social and community connection.

Generalization of PE learning is critical to improving functioning. Indeed, in life, generalization is the process in which a patient takes the specific exposure experience and applies it in new settings in different ways. This may involve a conscious process in which a patient may explicitly verbalize or think about the generalization. For instance, a patient who avoided grocery shopping may complete in vivo exposures that involve going to a specific grocery store. After treatment, that patient may say that they are only safe in that store, that chain of stores, or all grocery stores. These different statements, then, would reflect different types of generalization and relate to magnitude of symptoms reduction. The more widely patients apply the new learning, the more patients are able to do the things they want to do in life and make choices out of situational needs instead of trauma-related anxiety. In neuroscience as applied to PE, generalization is the specific expansion of extinction learning to relevant, although not identical, stimuli. As discussed in Part I, generalization gradients can be used to operationalize how widely a specific learned association is applied. When considering the extinction learning that is part of PE, therapists doing in vivo exposure are typically trying to promote maximal generalization, so that previously feared people, places, and situations are no longer considered dangerous and are now associated with safety. As such, it is important for the therapist to consider strategies to increase generalization that will provide the most benefit to the patient. This means systematically considering what variations of a specific in vivo item will be beneficial for this individual, with an eye toward making modifications to the plan based on patient response. Variations

to ensure generalization should begin with an understanding of the core fear that drives the avoidance and then include different versions of situations that hit that core fear. These variations may include lower or higher levels of the core fear stimulus (e.g., more or less frequent potholes), time of day, being with people or on one's own, and so on.

Finally, neuroscience of extinction learning supports that in vivo hierarchy items may be most effective when they allow for systematic repetition of the core fear/negative affect outcome. This repetition increases the likelihood of extinction and inhibitory learning processes. Extinction learning models support that increased repetition is related to lower spontaneous recovery (Singewald & Holmes, 2019) and would expect this to extend to exposure therapy.

ACTIVATION DURING IN VIVO EXPOSURE PRACTICE

Ensuring that in vivo exposures are maximally effective begins with working to identify and make specific the target of each in vivo. What is the core fear or negative consequence that drives the specific avoidance? How can the patient approach that feared consequence, stay with the emotional responses it provokes for a reasonable period, and repeat it many times? Sometimes the answers to these questions are not entirely clear before the first attempt at an in vivo. In such cases, it can be good for the therapist to take the stance of a scientist or detective, whereby they approach the situation and collect the needed information to refine the exposure to be even more effective subsequently. For instance, a patient who has not been to a movie in a theater for a while may not remember whether the aisle or the center seats are related to more anxiety/fear, but if they can test it out they can know for certain. An important piece of in vivo exposure is discussion of the experience with the therapist. (In-depth discussion of processing and ways to facilitate processing are presented in Chapter 11.) For our current discussion, processing includes discussing how the in vivo exposure went, whether it was harder or easier and why, what the patient learned from the exposure, and what they still need to learn. On the basis of how processing went, the exposure can be fine-tuned to target the specific feared consequence. For instance, if it becomes clear that a critical element was not present and the resulting in vivo was too easy, then that element can be added. An example of this may be a rape survivor who is doing exposure to crowded stores and reports a subjective units of distress (SUDS) rating of 50 and then discovers, during discussion, that she went with her partner, which made it easier. The next iteration of the in vivo item would specifically have her going shopping on her own and discussing the difference.

Neuroscience also provides important direction for therapists that between-session reductions in SUDS and psychophysiological arousal, but not within-session reductions, are most closely related to better outcomes (G.-J. Hendriks et al., 2015; S. A. M. Rauch et al., 2004; S. A. M. Rauch, King, et al., 2015). Even for between-session reduction, there is also evidence that the reduction in distress may be related to, but not necessarily required for, therapeutic benefit in PE—which is suggestive of inhibitory learning and affect tolerance (Bluett et al., 2014). In this way, when a patient is showing within-session changes, it can be a “bonus” support for progress; all the same, the therapist should focus discussion more on whether reductions in distress and arousal are happening across repetitions in time. If such patterns are not apparent, the therapist can look for common impediments to exposure, such as safety behaviors, not staying in the session long enough for the consequence to be felt, not repeating the exposure often enough to see benefit, or not being consistent enough in the exposure for it to feel like repetition. Sometimes it can be helpful to have many repetitions together, often called *massed exposure*, or to space the repetitions out. Massed presentations tend to be best for those exposures that the patient is having a tough time accomplishing until they begin to see some benefit. *Spaced exposures* tend to be good for continued practice and maintenance of gains over time. Finally, therapists should be watching for chances to vary exposures in order to work on generalization (as previously discussed).

Although *underengagement* (or low activation) is more common, some patients may emotionally connect with the memory so closely that they lose connection with the here-and-now, or they are not able to incorporate corrective information in the memory. This is called *overengagement*. In addition to those patients who overengage, some are afraid of losing control, which prevents them from connecting with the trauma memory. Preparatory interventions developed to get patients “ready” for PE have shown some evidence of efficacy, but research designs to date have not compared standard PE to these interventions (Beidel et al., 2011; Cloitre et al., 2010). In addition, any observed benefits of preparatory treatment must be weighed against possible negative effects of extending the course of treatment (increased dropout) and delaying exposure.

DISCRIMINATING SAFETY FROM THREAT

In previous chapters, we discussed the importance of context in extinction learning that is a critical element of PE. As noted in Chapters 1 and 2, people with PTSD show an overgeneralization of fear learning (Morey et al., 2015) and

more context-dependence in extinction learning (Liberzon & Abelson, 2016). As such, specifically and explicitly discussing safety and the limits of safety, as in vivo exposures are planned and completed, can help to overcome this tendency and increase the potency of a given in vivo exposure. To demonstrate, this can be as simple as talking with the trauma survivor about specific items being placed on the hierarchy and discussing whether these avoided situations would be avoided by their neighbors or peers. Such types of questions can help patients step out of their perspective for a moment to consider another way of viewing the risks in the world. Once this discussion occurs, then, together, patient and therapist can come to consensus on the relative risk of the situation. Of note for any exposure therapist, the goal is not to declare safety or risk, because we have to recognize not only that bad things can happen anywhere and at any time, but that each person needs to decide what level of risk they are willing to take on in order to have a life that is fulfilling. The level of risk for those with PTSD has been contaminated by their experience of trauma, and the job of therapists is to help them reconsider relative risk to decide a new normal that can work for them.

As we learn more about how PTSD develops and how PE works to treat PTSD in the brain and body, applying the cutting-edge research in clinical practice helps us increase magnitude or efficiency of response to a given session or whole treatment course. In doing so we may even be able to increase retention and response and expand the number of people impacted with PTSD who can achieve remission and reclaim their lives following trauma. In vivo exposure is the tool in PE that most specifically helps people suffering with PTSD to approach those activities that they used to do but that they now avoid due to trauma. Each step is a step toward function and freedom from the impact of PTSD.