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The Wilbarger Protocol

Brittany Hatlestad
Augustana College, Rock Island Illinois

Introduction: Pediatric occupational therapists (OT) focus on helping children overcome cognitive, fine motor, gross motor, self-care, and social difficulties, which enables them to grow into functional, independent adults (Pediatric Occupational Therapists). OTs often work with patients who struggle with a sensory processing disorder (SPD), as 5-10% of children without a disability and 40-88% of children with a disability have SPD (Ahn et al. 2004). One subtype of SPD is sensory overresponsitivity, which is defined as, "a person responding faster, more intensely, or for extended duration to sensation, in comparison with a person who has a typical response to sensation" (Miller et al. 2007). This diagnosis can result in children experiencing fear, irritability, aggression, or avoidance behaviors, thus impacting their everyday life (Reynolds et al. 2009). The prevalence of the diagnosis–in both typical and atypical children–has given rise to many different approaches and techniques to provide therapeutic sensory input. The most prescriptive, however, is the Wilbarger protocol (Kimball et al. 2007). With evidence continuing to emerge regarding the effectiveness of the Wilbarger protocol, further investigation is needed to understand the reliability and validity of the approach. This literature review will investigate what sensory problems are, the Wilbarger protocol, the deep pressure and proprioceptive portion of the protocol, oral tactile techniques, mechanisms of the protocol, the limitations, other options for treatment, and will conclude by looking to future research.

Sensory Problems: In order to appreciate the Wilbarger protocol, one must understand the reason such a treatment is needed–sensory problems. In 1972, Dr. A Jean Ayres first presented a sensory processing theory to explain the deficits some children have in interpreting stimuli from the body and environment, which then in turn impacts academic or motor learning (Weeks et al. 2012). The neurological basis for sensory challenges is the brain's inability to integrate the sensory input it receives from sensory systems and then give the effective responses

(Critz et al. 2015). Children with sensory integration and processing difficulties experience decreases in age-appropriate activities of daily living, social participation, and school (Arbesman et al. 2010).

As of late, there has been some inconsistency in the names "sensory integration" and "sensory processing." Although the terms tend to be used interchangeably, recent occupational therapy literature deemed it necessary to differentiate between the two. Sensory processing involves the management of both the peripheral and central nervous system, with regards to reception, modulation, integration, and organization of sensory input, as well as the behavioral responses (Miller and Lane 2000). Sensory integration, on the other hand, is the ability of the central nervous system to process the sensory input (Miller and Lane 2000). Therefore, this is just one component of sensory processing. Throughout the rest of this literature review, sensory processing will refer to the motor, cognitive, behavioral and emotional developmental processes of a child, as opposed to theory, intervention, and cellular activity (which concern sensory integration).

There are various treatment approaches for SPD that can be administered by therapists. According to Sarah Ybarra, pediatric occupational therapist, therapeutic approaches are determined based on the level of response children have to sensations (S. Ybarra, personal communication with author, August 29, 2018). If the child is hyposensitive, then he/she needs additional sensory input–their system becomes reorganized by spinning, crashing, jumping, and running. Others may be hypersensitive and therefore need safe, quiet places like sensory rooms or wearing clothing/equipment that protects from the environment (sunglasses, noise-blocking headphones, loose-fitting clothing). The approach that will now be discussed–the Wilbarger

protocol–is aimed at the children who are hyperresponsive, or otherwise termed, sensory defensive.

What is the Wilbarger Protocol: The Wilbarger protocol was created by Patricia Wilbarger, an occupational therapist and clinical psychologist who specializes in sensory defensiveness. Formally titled the Wilbarger Deep Pressure and Proprioceptive Technique (DPPT) and Oral Tactile Technique (OTT), the theory works to provide stimulation to help the mind, brain, and body self-organize (Wilbarger 2005). Consequently, it is hoped that children will have an increased ability to pay attention and transition between daily activities, decreased tactile defensiveness (fear of being touched), and increased self-regulation due to the ability of the central nervous system (CNS) to effectively process information from the peripheral nervous system. The DPPT portion of the protocol involves three components–brushing, joint compression, and a "sensory diet". First, the hands, arms, back, legs, and feet have deep pressured applied via a Therapressure brush. Following, the major joints are compressed in an attempt to stimulate the proprioceptive system. Finally, the child goes through a set of sensorimotor activities called the "sensory diet." The OTT portion of the protocol is used for those with oral defensiveness (Wilbarger 2005).

DPPT: As aforementioned, Wilbarger defined three DPPT aspects of the protocol, with the first being brushing (2005). The brush, clearly a critical factor, can be disposable brush, a corn brush, an oval brush, or a brush with a sponge. Each has different qualities that would make the therapist prefer one over the other for a certain client–for example, the oval brush is reusable (unlike the disposable) and it is easy to handle (unlike the corn brush), but it's softness may not activate some of the receptors in the skin. Ultimately, it is up to the therapist on which brush to use, as there are advantages and drawbacks to all. However, one concept is universal–the brush

must be tested for itch, tickle, or scratch before each use to ensure the sensory receptors are activated correctly.

When it comes to the brushing technique, it should be mentioned that it is more than just brushing. The key to results is the pressure touch sensation with the degree of pressure being comparable to the amount of force one would use to spread putty. Even pressure is crucial, so one must not brush too rapidly. The "brushing" should be done steadily–but never back and forth in the same area–with enough pressure that the bristles of the brush bend. When going over the skin, the brush should be horizontal to the direction of the stroke and vertical if going over fabric. If necessary, brushing can be done over clothes, but the results may have a less dramatic effect. The objective is to quickly fire multiple pressure touch receptors in large areas of the body: three swipes (either up/down/up or down/up/down) should be applied on both arms, tops of hands, palms, the back, and the legs and feet. Therapists may be trained to incorporate head/neck or spinal compressions, which shows enhanced results in some cases. The stomach should never be brushed during the Wilbarger protocol, as the amount of nerve ganglia located in the visceral organs can drive the nervous system into acute distress. Additionally, because the head/neck/face area are personal and protected spaces, brushing may only be done upon the individual's request.

Once brushing is complete, the compression component must follow. Compression is given as ten quick presses to the key joints of the upper and lower extremities–shoulders, elbows, wrists, hips, knees, and ankles. Therapists should support the joint with one hand above and one hand below to give jerky, firm compressions. The rapid compression "tricks" the brain into thinking that the bone has become displaced, so all of the proprioceptors in the area will fire at once to stabilize and protect the joint. Although brushing is not to be done to oneself, joint

compressions can be self-administered by jumping in place or doing push-ups off the wall. From the time of brushing to completion of joint compressions, therapists should take approximately three to five minutes to administer the technique. The entire regimen should be completed every ninety minutes to two hours both at school and home. The input the Wilbarger protocol is providing is known to last in the system for that amount of time, so it is necessary to repeat to help keep the individual in the optimal zone of sensory modulation. If the protocol is going to be effective for the patient, positive changes will be seen within several days. However, if there has been no evidence of a beneficial impact, then the technique should be evaluated and discontinued if necessary.

The last element of the DPPT, the sensory diet, is not as strictly regulated as the techniques required for brushing and joint compression. The "diet" is a set of activities and sensory input for the body and neurological system to keep its arousal level optimal. Occupational therapists will create specialized plans for each individual based on the amount and type of sensory input he/she needs. Not only will the DPPT help with tactile defensiveness (such as being hyperresponsive to tags on clothes), it will also raise body awareness in relation to oneself, the environment, and others. This will help with transitions between activities, interactions with peers, and even the efficiency one moves around a new space.

OTT: Oral tactile techniques is another element of the Wilbarger protocol, but it does not need to be used in conjunction with the DPPT unless necessary. Both occupational and speech therapists often treat individuals who have difficulty with oral motor control and difficulty regulating sensory input in the mouth. This can result in problems with speech and/or eating, as well as the desire to constantly put things in one's mouth, drooling, and picking food based on texture. In order to combat oral defensiveness, therapists utilize oral motor toys that work on

implementing different stimulation of the mouth via massage or blowing techniques (straws, whistles) and introducing different textured food. Like all therapy, there is not a universal solution to oral defensiveness. OTs and speech therapists must work together to find the combination that provides the right type of input to improve oral motor control (Wilbarger 2005).

Mechanisms: When considering the anatomical components of SPD, it begins at the neuronal level. The sensory processing system is composed of sensory neurons and sensory receptor cells, neuronal pathways, and the brain areas involved in sensory perception (Sensory Processes). Each of the five senses (touch, taste, vision, hearing, smell), as well as balance, have their own processing system that allows for the physical world to be represented within the brain. Based on the type of stimulus applied, there is a specific receptor to transduce the signal into an action potential that travels along the neuronal pathway (Sensory Processes). There are four types of stimuli with corresponding sensory receptors: chemicals/chemoreceptors, temperature/thermoreceptors, pressure/mechanoreceptors, and light/photoreceptors. These sensory receptors perform countless functions in the human body (Sensory Receptors). Consequently, hypersensitivity of sensory input can cause exaggerated responses, as Dr. A. Jean Ayres found during her neurobiological study of SPD.

Just as Dr. A. Jean Ayres was the pioneer for sensory processing theory, she proposed a neurological basis for SPD. Using her postdoctoral training as a neuroscientist, Dr. Ayres found that sensory modulation occurs as the CNS regulates the neural messages about sensory stimuli. Consequently, SPD results when a person does not respond with the appropriate behavior based on the given stimuli input. Sympathetic nervous system activation is a marker for overresponsitivity (Miller et al. 1999), which could result in various kinds of behavior–

aggressive, impulsive, active, or negative (Miller et al. 2007). Additionally, sensory input has a summative effect. Therefore, if the information is not processed correctly or efficiently, a trivial event could cause an exaggerated response in those struggling with SPD (Miller et al. 2007). It is evident that the sensory processing system is multifaceted and can often be understood in the Pyramid of Learning, created by Williams and Shellenberger in 1996. By considering the interplay of sensations, one will better be able to understand the effectiveness of the Wilbarger protocol.

The Pyramid of Learning begins with the CNS, as that is the neurological basis of sensory input (as previously stated by Ayres). The next tiers include sensory systems, sensory motor development, and perceptual motor development, which leads to the top tier of cognition and intellect. The Wilbarger protocol addresses the three areas that make up the foundation of the pyramid–tactile, vestibular, and proprioception. According to Pat McCaw, occupational therapist, those with SPD will never be able to reach any level of the pyramid (motor planning, hand-eye coordination, perceptual skills, behavior regulation, academic learning, etc.) if the lower level is not satisfied. With the sensory diet, tactile, vestibular, and proprioceptive activities are provided in the hope it will teach the body to self-regulate sensory input. Once the occupational therapist satisfies the initial base of sensory processing, the child will be able to reach higher levels of learning and allow them to be a more productive member of society (P. McCaw, personal communication with author, September 23, 2018).

Limitations of Research: There are many limitations to the studies involving the Wilbarger protocol. The first is the quantity–Weeks, Boshoff, and Stewart (2012) completed a systematic review on the Wilbarger protocol and only four studies were included for the in-depth review, as they qualified as intervention (pretest/posttest) and were published in a peer reviewed

journal. The external validity of the research was threatened, as all four studies had extremely small sample sizes, so the research could not be generalized to wider populations. Furthermore, the internal validity, which refers to how precisely the research question is answered and the confidence that the results are due to a causal relationship between the independent and dependent variables, was threatened (Weeks et al. 2012). Benson et al. completed a case study on the Wilbarger protocol that shows apparent bias when selecting participants for the protocol (2011). The sample population was chosen based on the child's previous positive responses to somatosensory input and was therefore thought to have a greater chance of benefiting from treatment like the Wilbarger protocol (Benson et al. 2011). Another element that negatively impacted the internal validity includes maturation–the children simply had decreased hyperresponsivity responses as they became older (Weeks et al. 2012).

It is confounding how the Wilbarger protocol is one of the most prescribed techniques for sensory hypersensitivity treatment yet there is a lack of quality research to support claims. One potential cause could be attributed due to the strenuous program schedule required for administration that the program needs to be administered, resulting in parental adherence to the protocol to be low. Whether it be due to their child's negative initial response to brushing, lack of evidence of immediate progress of the intervention, or the rigorous schedule, parents find it difficult to consistently follow the recommended protocol (Segal & Beyer 2006). Throughout the systematic review completed by Weeks and colleagues, they were unable to draw any universal claims regarding the effectiveness of the treatment (2012). Although that may be discouraging to some, it should be understood that each child is unique and will therefore respond differently to any technique. A variety of programs should be offered to parents and children, including the Wilbarger protocol, because one will never know what is the most beneficial until it is tried.

Keeping that in mind, the resistance the Wilbarger protocol encounters should be taken with a grain of salt, as there is not one program that guarantees results for any child with any level of sensory defensiveness and accompanying diagnoses.

Other Techniques: With the Wilbarger protocol having limited research support thus far, it is necessary to consider other options for sensory input. The ultimate goal of sensory input is to address the underlying sensory defensiveness in order to reach developmental and social success. Any technique introduces tactile experiences slowly and gradually to teach one's nervous system how to interpret touch sensations and stimulation (Wilbarger 2005). There are many options other than the Wilbarger protocol for sensory input. With tactile defensiveness, children need to touch a variety of textures in order for them to develop normal processing. Therefore, playing with play-doh, "goop," sand and water, or any other differently-textured object will introduce those new tactile experiences. Another common option is what is called "heavy work activities." For children who have difficulty regulating their arousal levels, using weights, jumping, bouncing, crashing, rocking, swinging, pushing, and pulling will give appropriate, regular input into their muscles and joints so they can settle their bodies down. Along the same lines as "heavy work" is vestibular activities. This is focused more on swinging and rocking in a way that provides organized input. Another form, proprioceptive activities, is necessary to regulate motor control and planning, body awareness, knowing the difficulty of a task, and postural stability. A deficient proprioceptive sense will make children have difficulty with both gross and fine motor tasks, so it is essential to address this issue (Wilbarger 2005). A common activity aimed at proprioceptive awareness is having the child swing and throw bean bags into a bucket–this activity requires planning, knowing where one's body/swing is in relation to the bucket, how hard to throw the bean bag, and maintaining posture and head control to be

able to look for the target (S. Ybarra, personal communication with author, August 29, 2018). The many options listed here do not constitute all of the techniques available for sensory input. As aforementioned, there is not one universal protocol that will satisfy every children's varying need of input; therefore, therapists need to try out many different techniques to know which one works best for the child.

Future Research: There are many limitations regarding the study of the Wilbarger protocol; however, limitations provide more opportunities for future researchers to better understand the implementation and response to the protocol. Studies with larger sample sizes would create stronger external validity. Furthermore, the design of the experiments should include random assignment to exclude selection bias. Sample populations should receive the same style and amount of other therapy as normal during testing time, as that will ensure there are no other variables impacting the child's response. It is also important to establish that the children receiving the treatment are a part of an environment–therapist, teacher, and home–that will religiously follow the recommended 90-120-minute intervals between brushings. These improvements will hopefully allow for causal relationships to be determined–that the progression (or even regression or stagnation) of the child's response to sensory stimuli is due to the protocol and not outside variables.

Conclusion: With sensory processing disorder affecting such a large population of children both with and without disabilities, it is necessary to be informed on techniques that attempt to combat sensory hyperresponsivity. As expressed by the Pyramid of Learning, having a strong foundation in processing sensory stimuli is necessary to succeed on all other aspects of life–socially, emotionally, mentally, and academically. With the advancement of science and technology, many protocols have been created that aim to satisfy that foundational level of the

pyramid at a young age to best prepare those who are hypersensitive to succeed in activities of daily living. The Wilbarger protocol, although faced with many limitations, has proven to have a drastically positive impact in some cases. When evaluating the findings from various studies, it is important to keep in mind that there will never be one universal protocol that satisfies every level of the spectrum. The additive quality of many of these disabilities makes it difficult to find an appropriate treatment, so the Wilbarger protocol is a necessary tool to have in the OTs repertoire when he/she is attempting to put together the seemingly impossible puzzle of a diagnosis and treatment plan. In order to be most effective, the Wilbarger protocol needs to be followed by OTs, teachers, and home support alike. When analogously comparing the protocol to a diet, the end goal of weight loss will never be achieved if one only eats healthy at breakfast and sometimes at lunch. Similarly, the protocol will never be effective if it is only followed at therapy, sometimes at home, but never in the classroom (or any combination of the three). Although the journey of response to sensory hyperresponsivity is not yet complete, Wilbarger made great waves in her theory of activating sensory receptors in order to promote organized input. As research and discoveries progress, the Wilbarger protocol will be amended to better suit the current need of individuals with SPD to positively impact the lives of those who struggle with sensory processing.

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