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Title: Use of a Weighted or Pressure Device to Modify Behavior in Children with a Sensory Processing Disorder

Clinical Question:

P (population/problem): In children with sensory processing difficulties over the age of one **I** (intervention): is the use of a therapeutic weighted or pressure device (passive input)

C (comparison) compared to no passive input

O (outcome): effective in improving a child's behavior (self-stimulatory behaviors and

attention to task) or arousal level?

Target Population: Children over the age of one year old with sensory processing difficulties

Exclusions:

• Therapeutic weighted device: Children with compromised posture, children with poor postural endurance, children with poor skin integrity

• Therapeutic pressure device: Children with poor skin integrity

Definitions:

- Therapeutic Weighted Devices: Pieces of equipment or garments that provide proprioceptive and deep-touch input to a person's body through application of weight.
- Therapeutic Pressure Devices: Pieces of equipment or garments that provide proprioceptive and deep-touch input to a person's body through compression.

Recommendations: (See *Table of Recommendation Strength* following references)

- 1. It is recommended that the decision to use therapeutic weighted devices be determined by clinical judgment of the therapist with consideration of child and family preferences for children with sensory processing difficulties who present with:
 - a. poor attention to task (VandenBerg 2001 [3b], Fertel-Daly 2001 [4b])
 - b. self-stimulatory behaviors (VandenBerg 2001 [3b], Fertel-Daly 2001 [4b])
 - c. increased arousal level (Local Consensus [5])
 - d. sensory modulation difficulties (Local Consensus [5]).

Note: Low level evidence suggests that weight and pressure inputs provide both tactile and proprioceptive input to the body that is theorized to be calming to the central nervous system (*Stephenson 2009 [1b], Fertel-Daly 2001 [4b], Grandin 1992 [4b]*).

- 2. It is recommended that when applying a therapeutic weighted vest:
 - a. weights be distributed evenly around the vest (Local Consensus [5])
 - b. total weight for initial application is recommended to be 5% of body weight; modifications may be made based on therapist's clinical reasoning (*Local Consensus* [5], Olson 2004a [5b], Olson 2004b [5b]).
- 3. It is recommended that the decision to use therapeutic devices that provide pressure be determined by clinical judgment of the therapist with consideration of child and family preferences for children with sensory processing difficulties who present with:

- a. increased arousal level (Edelson 1999 [4b])
- b. anxiety (Edelson 1999 [4b])
- c. poor attention to task (Local Consensus [5])
- d. sensory modulation difficulties(Local Consensus [5])
- e. postural control difficulties(Local Consensus [5]).
- 4. It is recommended that when applying a pressure vest:
 - a. pressure level be adjusted to the child's preference
 - b. skin integrity be assessed after wearing for twenty minutes
 - c. skin integrity be assessed with signs of discomfort
 - d. child be monitored for signs of overheating

(Local Consensus [5]).

- 5. It is recommended, when using with children who have a background of trauma such as physical abuse, that caution be used when applying therapeutic weighted or pressure devices (*Local Consensus* [5]).
- 6. There is insufficient evidence and a lack of consensus to make a recommendation on the length of time (minutes) therapeutic weighted and pressure devices may be used.

Discussion/Summary of Evidence:

The body of evidence to support the use of therapeutic weighted vests and pressure devices is low and inconsistent. Olsen and Olsen (2004) conducted a study to examine the use of therapeutic weighted vests in pediatric occupational therapy practice. A total of 341 surveys were returned. The authors found that "respondents who use therapeutic weighted vests were more likely to have advanced degrees or certifications and more years of experience as pediatric therapists" (Olson 2004a [5b], Olson 2004b [5b]). Therapists often stated that the use of therapeutic weighted vests increased the child's on-task behaviors, ability to remain in his/her seat, and attention. Therapeutic weighted vests were generally used with preschool and young elementary school-aged children with diagnoses of autism or attention deficit disorder.

Although Olsen (2004) found that almost 57% of survey respondents used therapeutic weighted vests in their practice, research is limited regarding the effectiveness of using therapeutic weighted vests (Olson 2004a [5b], Olson 2004b [5b]). A systematic review by Stephenson (2009) evaluated 7 research studies that explored the effectiveness of therapeutic weighted vests; the sample included results from 20 children (Stephenson 2009 [1b]). Four of the seven studies in this review "concluded that therapeutic weighted vests were an ineffective intervention" (Stephenson 2009 [1b]). Two of the seven studies yielded positive results including clinically significant improvements with focused attention and decreased self-stimulatory behaviors in 5 children with autism (Fertel-Daly 2001[4b]) and clinically significant improvements in on-task behavior in 4 children with attention deficit hyperactivity disorder (VandenBerg 2001 [3b]). These studies did not report statsistical significance.

More recent studies have shown that therapeutic weighted vests were ineffective in improving target behaviors. Cox found that therapeutic weighted vests did not improve children's ability to remain in their seats but playing with a preferred object did improve children's ability to remain in their seats (*Cox 2009 [3b]*). Leew did not find a statistically significant difference in joint attention or elimination of competing behaviors when children wore therapeutic weighted vests. However, Leew found that parenting morale reached statistically significant improvement (p<.05) in one of four parents, and there was a clinically meaningful difference in the morale of three of four parents (*Leew 2010 [4b]*). Collins and Dworkin found no statistical significance in on-task behavior between subjects and controls. While teachers in this study provided anecdotal evidence for improved behavior, the author discussed multiple confounding variables that may have contributed to these qualitative results (*Collins 2011 [2b]*).

Specific protocols for therapeutic weighted vest use are not currently available in the literature. In a phone survey on therapeutic weighted vest use, therapists reported using 2 to 5 pounds or 5 to 10% of the child's body weight (Olson 2004a [5b]). While there are no specific recommendations regarding the amount weight to use in a therapeutic weighted vest, the American Academy of Pediatrics (2011) recommends backpacks weigh no more than 10 to 20 percent of a child's body weight as greater weight could lead to injury. It may be helpful to adhere to this standard

when using other weight items. The amount of time therapeutic weighted vests were worn within studies varied from 30 minutes (*VandenBerg 2001 [3b]*) to 120 minutes at one time (*Fertel-Daly 2001 [4b]*).

Compared to therapeutic weighted vests, there was limited mention of therapeutic pressure devices in the literature. Results of Grandin's study suggest that full body deep pressure provided by a therapeutic pressure device (called the squeeze machine) may have a relaxing effect, but this effect varies from person to person (*Grandin 1992 [4b]*). Edelson and colleagues provide further support that the use of deep pressure decreases arousal and anxiety. However, it is unknown whether this decreased arousal translates to improved functional outcomes (*Edelson 1999 [4b]*).

Health Benefits, Side Effects and Risks:

- Potential risks of weighted device use include muscular fatigue, skin irritation, discomfort, and over-heating.
- Potential risks of pressure devices include skin irritation, discomfort, and over-heating.

References/Citations: (evidence grade in []; see Table of Evidence Levels following references) **Note:** When using the electronic version of this document, ♥ indicates a hyperlink to the PubMed abstract.

- 1. **Blanche, E., and Schaaf, R.:** Proprioception: A cornerstone of sensory integrative intervention. *Understanding the nature of sensory integration with diverse populations,* 1: 109-124, 2001, [5b].
- 2. **Collins, A., and Dworkin, R. J.:** Pilot Study of the Effectiveness of Weighted Vests. *The American Journal of Occupational Therapy*, 65(6): 688-694, 2011, [2b]
- 3. **Cox, A. L.; Gast, D. L.; Luscre, D.; and Ayres, K. M.:** The effects of weighted vests on appropriate in-seat behaviors of elementary-age students with autism and severe to profound intellectual disabilities. *Focus on Autism & Other Developmental Disabilities*, 24(1): 17-26, 2009, [3b].
- 4. **Edelson; Edelson; Kerr; and Grandin, T.:** Behavioral and physiological effects of deep pressure on children with autism: a pilot study evaluating the efficacy of Grandin's Hug Machine., 1999, [4b] .
- 5. **Fertel-Daly, D.; Bedell, G.; and Hinojosa, J.:** Effects of a weighted vest on attention to task and self-stimulatory behaviors in preschoolers with pervasive developmental disorders. *American Journal of Occupational Therapy*, 55(6): 629-640, 2001, [4b] .
- 6. **Grandin, T.:** Calming effects of deep touch pressure in patients with autistic disorder, college students, and animals. *J Child Adolesc Psychopharmacol*, 2(1): 63-72, 1992, [4b] _____ •.
- 7. **Leew, S. V.; Stein, N. G.; and Gibbard, W. B.:** Weighted vests' effect on social attention for toddlers with Autism Spectrum Disorders. *Can J Occup Ther*, 77(2): 113-24, 2010, [4b]______ •.
- 8. **Local Consensus:** during the guideline development timeframe. ed., [5].
- 9. **Miller, L. J., Anzalone, M.E., Lane, S.J. Cermak, S.A. & Osten, E.T.:** Concept Evolution in Sensory Integration: A Proposed Nosology for Diagnosis. *American Journal of Occupational Therapy,* 61: 135-139, 2007, [5a]
- 10. **Miller, L. J., Reisman, J. McIntosh, D., & Simon, J.:** An Ecological Model of Sensory Modulation: Performance of Children with Fragile X Syndrome, Autistic Disorder, Attention -Deficit/Hyperactivity Disorder, and Sensory Modulation Dysfunction. In *Understanding the nature of sensory integration with diverse populations*, pp. 57-88. Edited by Roley, S., Blanche, E, & Schaaf, R, Austin, Texas, PRO-ED, Inc., 2001, [5b]
- 11. **Olson, L. J., and Moulton, H. J.:** Occupational therapists' reported experiences using weighted vests with children with specific developmental disorders. *Occupational Therapy International*, 11(1): 52-66, 2004a, [5b].
- 12. **Olson, L. J., and Moulton, H. J.:** Use of weighted vests in pediatric occupational therapy practice. *Physical & Occupational Therapy in Pediatrics*, 24(3): 45-60, 2004b, [5b]
- 13. **Stephenson, J., and Carter, M.:** The use of weighted vests with children with autism spectrum disorders and other disabilities. *Journal of Autism & Developmental Disorders*, 39(1): 105-14, 2009, [1b]______.
- 14. **VandenBerg, N. L.:** The use of a weighted vest to increase on-task behavior in children with attention difficulties. *American Journal of Occupational Therapy*, 55(6): 621-628, 2001, [3b]

Introductory/Background Information:

Therapeutic weight and pressure are used as therapeutic tools in occupational therapy treatment for children with sensory processing difficulties. Sensory processing difficulties can be divided into three major areas including sensory modulation disorder, sensory discrimination disorder, and sensory-based motor disorder. Each area can be further broken down into subtypes. For example, sensory modulation disorder is composed of three subcategories including sensory over-responsivity, sensory under-responsivity, and sensory seeking (*Miller 2007 [5a]*). Children with sensory modulation difficulties may present with difficult behaviors, decreased ability to attend to tasks, impulsiveness, disorganization, extremes in activity level, anxiety, and poor self-regulation (*Miller 2001 [5b]*).

Deep pressure and proprioceptive input are often considered to be calming sensory inputs and are frequently used as therapy tools when treating persons with sensory modulation disorder (*Blanche 2001 [5b]*). Pressure and proprioceptive input can be applied both passively (i.e. therapeutic weighted vest) and actively (i.e. use of a self-controlled pressure device). These sensations are believed to promote integration within the central nervous system that allows an individual to produce an appropriate and functional response to the environment (*Blanche 2001 [5b]*). Use of weight and pressure devices provide deep pressure inputs to the body and help to modulate an individual's response to more noxious or excitatory stimuli.

BESt Development Team:

Kristen Brevoort, MOT, OTR/L, Team Leader, Division of Occupational Therapy and Physical Therapy Amy Brennan, MS, OTR/L, Division of Occupational Therapy and Physical Therapy Victoria McQuiddy, MHS, OTR/L, Division of Occupational Therapy and Physical Therapy

Senior Clinical Director

Rebecca D. Reder OTD, OTR/L, Division of Occupational Therapy and Physical Therapy

James M. Anderson Center for Health Systems Excellence

Karen Vonderhaar, MS, RN, Methodologist, Guidelines Program Administrator

Ad hoc Advisors

Mary Gilene, MBA, Division of Occupational Therapy and Physical Therapy Michelle Kiger, OTR/L, Division of Occupational Therapy and Physical Therapy

All Team Members and Clinical Effectiveness support staff listed above have signed a conflict of interest declaration.

Search Strategy:

Articles: Eleven articles were found to be appropriate for review.

Search Engines: OVID MEDLINE, OVID CINAHL, OVID EBM Reviews (Cochrane), PubMed Clinical Queries, AOTA, APTA's Hooked on Evidence, APTA Section of Pediatrics, Can Child, CATS, PEDro, Pediatric PT, SPD Foundation, Spiral Foundation, TRIP

Search Terms: Compression, Compression+garment, Pressure Devices, Benik, Theratogs, Miracle belt, Body sock, Lycra shirts, Bear hug, Weighted vest, Weighted belt, Weighted lap pad, Weighted hats, Weighted gloves, Weighted balls, Weighted backpack alone, and as Boolean phrase: +sensory integration, +Autism, +ADHD, +Occupational Therapy, +Children, +Behavior, +Self-stimulation

Search Limits: English language, year: 1980 through July 2011

Applicability Issues:

The cost and burden of obtaining and maintaining a variety of therapeutic weighted and/or pressure devices may be a barrier to implementing the aforementioned recommendations.

Note: Full tables of evidence grading system available in separate document:

- Table of Evidence Levels of Individual Studies by Domain, Study Design, & Quality (abbreviated table below)
- Grading a Body of Evidence to Answer a Clinical Question
- Judging the Strength of a Recommendation (abbreviated table below)

Table of Evidence Levels (see note above)

Quality level	Definition
1a [†] or 1b [†]	Systematic review, meta-analysis, or meta-synthesis of multiple studies
2a or 2b	Best study design for domain
3a or 3b	Fair study design for domain
4a or 4b	Weak study design for domain
5a or 5b	General review, expert opinion, case report, consensus report, or guideline
5	Local Consensus

[†]a = good quality study; b = lesser quality study

Table of Recommendation Strength (see note above)

Strength	Definition					
It is strongly recommended that	There is consensus that benefits clearly outweigh risks and burdens					
It is strongly recommended that not	(or visa-versa for negative recommendations).					
It is recommended that	There is consensus that benefits are closely balanced with risks and burdens.					
It is recommended that not						
There is insufficient evidence and a lack of consensus to make a recommendation						
Dimensions for Judging the Strength of the Recommendation						
Reflecting on your answers to the dimensions below and given that more answers to the left of the scales indicates support for a stronger						
recommendation, complete one of the sentences above to judge the strength of this recommendation.						
(Note that for negative recommendations, the left/right logic may be reversed for one or more dimensions.)						
1. Grade of the Body of Evidence	☐ High	☐ Moderate	⊠ Low			
2. Safety/Harm (Side Effects and Risk		☐ Moderate	Serious			
3. Health benefit to patient	Significant	☐ Moderate				
4. Burden on patient to adhere to	Low	Unable to determine	High			
5. Cost-effectiveness to healthcare	Cost-effective	☐ Inconclusive	Not cost-effective			
6. Directness of the evidence for th	Directly	Some concern of	Indirectly relates			
		relates	directness			
7. Impact on morbidity/mortality of	☐ High	☐ Medium	⊠ Low			
Comments on Dimensions (optional):						

Copies of this Best Evidence Statement (BESt) are available online and may be distributed by any organization for the global purpose of improving child health outcomes. Website address: http://www.cincinnatichildrens.org/svc/alpha/h/health-policy/ev-based/default.htm. Examples of approved uses of the BESt include the following:

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Note:

This Best Evidence Statement addresses only key points of care for the target population; it is not intended to be a comprehensive practice guideline. These recommendations result from review of literature and practices current at the time of their formulation. This Best Evidence Statement does not preclude using care modalities proven efficacious in studies published subsequent to the current revision of this document. This document is not intended to impose standards of care preventing selective variances from the recommendations to meet the specific and unique requirements of individual patients. Adherence to this Statement is voluntary. The clinician in light of the individual circumstances presented by the patient must make the ultimate judgment regarding the priority of any specific procedure.

The Best Evidence Statement has been reviewed against quality criteria by 3 independent reviewers from the CCHMC Evidence Collaboration.