

Wireless, *In-Situ* Measurement of Electrodermal Activity During Occupational Therapy

Elliott B. Hedman, B.S.¹, Lucy J. Miller, Ph.D.², Mathew S. Goodwin, Ph.D.¹,
Rosalind W. Picard, Sc.D.¹

¹Massachusetts Institute of Technology, Cambridge, Massachusetts

²Sensory Processing Disorder Foundation, Greenwood Village, Colorado

Background: Occupational therapists strive to help children and adults better understand and regulate their physiological arousal. Physiological arousal is often assessed by electrodermal activity (EDA), a peripheral measure of the sympathetic nervous system. Traditionally, EDA is measured on the finger tips via electrodes wired to a computer. This equipment constraint can make measuring physiological arousal during active therapy sessions very difficult, if not impossible.

Objectives: iCalm – a wireless, comfortable sensor worn like a sweatband on the wrist or ankle – can measure EDA and physical activity responses over long periods of time in natural settings. The current study asked children to wear iCalm during Occupational Therapy (OT) to explore: (1) how usable iCalm is for children with sensory challenges while they participate in active therapy sessions, and (2) what relationships exist between EDA and specific OT interventions.

Methods: 22 children, ages 3-12, with a diagnosis of ASD, ADHD, and/or Sensory Processing Disorder wore iCalm for one-hour OT sessions (n=85 sessions). Repeated measurements (2 to 6 times for each child) provided internal reliability. EDA was synced with a video feed for post-event annotation. Parents and therapists were also repeatedly asked about iCalm's comfort, feasibility, and utility.

Results: All children in the study tolerated wearing iCalm for the duration of their OT sessions. Detailed visual analyses of the EDA data revealed that specific OT activities consistently increased or decreased children's physiological arousal. For example, a child gently rocked in a lycra swing repeatedly showed a sharp decrease in his EDA. An activity where a child listened to herself speak on a microphone that amplified her voice into earphones tended to increase her EDA. Temporal variation in EDA was also found across participants, with generally lower EDA in the morning than afternoon sessions.

Conclusion: Assessing physiological arousal during active OT sessions appears to have a number of benefits. First, we were able to identify when and how specific interventions impacted a child's physiological arousal, suggesting that EDA may be a useful measure of treatment effectiveness. Second, repeated measurements across participants at various times in the day suggest there may be optimal and suboptimal times to deliver OT, depending on whether the intent is to increase or decrease arousal. Finally, our qualitative results suggest that giving children, therapists, and parents live feedback from iCalm may also provide new methods to learn how a child with ASD's environment and internal state interact.

Sources of Funding: Nancy Lurie Marks Family Foundation, Wallace Research Foundation