Title: A Preliminary Evaluation of the Reliability of Skin Temperature Measurement in Rett Syndrome

Authors: Breanne J. Byiers, Chantel C. Barney, Alyssa Merbler, & Frank J. Symons

Introduction: Peripheral vasomotor dysfunction is a common clinical problem among individuals with Rett syndrome (RTT) and related disorders (Neul et al., 2010). The issue has received little scientific attention. A previous study documented the feasibility of using portable/hand-held infrared thermography (IRT) as a noninvasive tool to characterize peripheral skin temperatures in a sample of individuals with RTT (Symons et al., 2015). Although feasibility was demonstrated, the study findings were limited to a single time-point temperature measure for each participant. In other domains, empirical studies have documented that physiological measures, for which reliability and validity are widely assumed, show remarkable variability in reliability within and across groups. As such, some researchers have argued that the psychometric properties of physiological measures should undergo the same types of evaluations as self-report measures (Tomarken, 1995). The purpose of the current study was to conduct a preliminary evaluation of the internal and temporal consistencies of IRT-derived skin temperature measures in a sample of individuals with Rett and related syndromes.

Method: A sample of 6 females with Rett and related neurodevelopmental syndromes (aged 2-16 years at initial visit, 1 participant was diagnosed with CDKL5) participated in the study. For each participant, the average limb temperature was calculated based on IRT imaging as described in Symons et al. (2015). Average temperature of hands and feet, degree of right-left asymmetry (with positive values indicating right side warmer than left and negative indicating the reverse) of hands and feet, and absolute asymmetry (absolute value of the difference between limbs) of hands and feet were calculated for each participant. Data collection was repeated at brief intervals within session (approximately 30 minutes apart) with all participants, and at longer intervals (between 2 and 6 months apart) with 4 participants. Internal consistency of measurement points making up each average value was evaluated using Cronbach’s alpha. Temporal consistency was evaluated by calculating Pearson correlations between individual scores within and across visits.

Results: All measures showed strong internal consistency (range = 0.82-0.94). Average hand temperatures showed the most consistent temporal reliability, with a 30-minute reliability coefficient of 0.91, and inter-session (2-6 month) reliability of 0.923. On the other hand, foot temperatures showed strong consistency within-session (r = 0.97), but the inter-session reliability was poor at 0.03. For asymmetries of hands, the within- and across-session reliability coefficients were adequate, at 0.86 and 0.83 respectively when directional information was included, and 0.63 and 0.65 when only absolute differences were considered. For asymmetries of the feet, coefficients were 0.93 within and -0.48 between sessions with directional information, and 0.24 within and 0.23 between sessions with absolute differences alone.

Discussion: The data (so far) suggest that IRT-based analyses of peripheral skin temperature have adequate internal consistency, but that temporal reliability may differ across the measures. As psychometric properties of measures are specific to populations (rather than inherent to the measure itself), it is unclear the degree to which these findings are specific to this syndrome group. If scores based on these methods are to be used to examine individual differences, and/or change over time particularly in regard to therapeutic trials, the psychometric properties of the measures need to be documented in larger samples, and across different populations. Additional research is also required to identify whether hand temperatures and asymmetries are related to other indicators of health and autonomic dysfunction in the RTT population.

References/Citations: