The clinical utility of tracking hand skin temperature before and after daily relaxation practice in individuals with Chronic Sympathetic Activation

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Dysfunction in the autonomic nervous system (ANS) has been long considered as a significant factor in the development of many disorders that involve the end-organs of the autonomic nervous system. For example, in 1927, Wolf and Thomas wrote a paper entitled “Gastroduodenal ulcers and autonomic balance” in the Archives of Neurology and Psychiatry. To this day, research continues in the relationship between autonomic function and irritable bowel syndrome (Orr et al., 2000) and abdominal pain (Sowder, 2007). A relationship between autonomic dysfunction and disorders ranging from panic disorder (Friedman & Thayer, 1998) to cardiovascular disease (Recordati, 2003) has been shown. An excellent review of the relationship between autonomic dysfunction and a variety of clinical disorders, including chronic orthostatic intolerance, essential hypertension, panic disorder, congestive heart failure, and chronic fatigue syndrome is provided in a published NIH symposium entitled “Dysautonomias: Clinical Disorders of the Autonomic Nervous System”. Further, an interesting evolutionary displacement model that purports to explain why many diseases reflect dysfunctions of autonomic balance, was published by Yun et. al. (2004) in Medical Hypotheses.

It is not clear whether the disturbance in autonomic balance in psychophysiological disorders is a result of overactivity in the sympathetic nervous system (SNS) or withdrawal of the parasympathetic nervous system (PNS). For example, in migraine headache, Micieli et al. (1995) found that migraineurs’ responses to a cold pressor test revealed an excessive SNS response compared to a control group. The study also showed that giving the migraineurs Clonidine prior to the test could normalize their response. Since Clonidine suppresses SNS pathways, this suggests that excessive SNS activity is a significant factor in the production of migraine headache. On the other hand, there is also some recent evidence that there may be a dysfunction in the PNS rather than the SNS. Sanya et al. (2004) found a normal SNS response in migraineurs, but they also found an abnormal PNS response. Since the PNS is designed to counterbalance SNS, an impairment of the PNS could allow a normal SNS response to be more predominant than it would normally be.

Whether it is an overly active SNS, or an SNS that won’t shut off properly once activated, or a PNS impairment that is not properly counterbalancing the SNS, or a combination these, the ANS appears to be implicated in a significant number of psychophysiological disorders. And therefore, frequently measuring ANS activity during the course of biobehavioural treatment of these disorders should be an important component of tracking progress. While there are now sophisticated measures such as heart rate variability (HRV) which can be used to detect the relative contributions of both the SNS and the PNS (Thayer & Brosschot, 2005, Zhong et. al., 2006), these measures are not easy or inexpensive to use with clients at home. Hand skin temperature however, has the potential of been a reliable and inexpensive measure that can be used by clients on a daily basis at home.

Hypotheses

1. It was hypothesized that individuals presenting with Chronic Sympathetic Activation (CSA), irrespective of problem type, would benefit from intervention focused on reducing sympathetic arousal and restoring autonomic balance.
2. It was also hypothesized that hand skin temperature (HST) recorded before and after daily relaxation practice at home would:
   a. Be an easy and inexpensive method of tracking reductions in sympathetic arousal,
   b. Be a source of motivation to continue daily practice over lengthy timeframes
   c. Inform the process by showing progress over time.

Method
Seven participants (6 female, 1 male) were examined using a repeated measures, multiple baseline type design. Presenting problems included chronic headache, pain and stress subsequent to significant motor vehicle accidents, anxiety and life stress. Mean age was 38.3 yrs. (sd=19.1) with a range of 16 to 74 years. Subjects were identified as having CSA based on an average weekly HST of 85°F or less for 3 consecutive weeks. Treatment included daily home practice with a relaxation CD with HST recording pre and post practice. Treatment also included office sessions during which subjects were exposed to HST and respiration biofeedback, support, and cognitive behavioural therapy as needed. Each home practice session was approximately 25 minutes listening to either a progressive muscular or autogenic type relaxation CD. HST was recorded from the distal phalange of the index finger of the non-dominant hand using the digital thermometer supplied in the ‘Relaxation By The Numbers’ home training kit. HST was recorded at the beginning and end of each practice and was averaged over the week.

Results
The results (Figure 1) show a gradual increase in pre-practice HST at home of 10.3°F from 78.0 °F (sd=4.10) to 88.3 (sd=2.18) (p<.0007). This increase occurred over a range of 15 to 46 weeks (mean=27.1 wks, sd=12.8). The results also show a gradual increase in post-practice HST at home of 10.0°F from 84.5 °F (sd=6.58) to 94.5 (sd=3.58) ( p<.0004).

There was a positive relationship between the increase in pre-practice HST and ability to achieve the relaxed range (95°F) within home practice sessions. Irrespective of gender, age, number of sessions, mix of treatment, significant improvement in symptoms occurred when subjects’ average weekly pre-practice HST approached the normal range (90°F). HST recording before and after daily practice was reported to be easy and was a significant maintaining factor in keeping up daily home practice over many weeks.

![Figure 1](image-url)

Average hand skin temperature before and after daily relaxation practice at home for seven individuals with chronic sympathetic activation

Training epochs - Average number of weeks per epoch = 2.7 wks.
As pre-practice HST's approached the normal range (90°F), participants reported significant reductions in chronic headache, other pain, analgesic intake, anxiety, avoidance behavior, and dizziness. They also reported feeling generally calmer.

Conclusions

Average weekly HST was easy to record and allowed participants to track their progress. Participants reported that seeing the progression in their HST week to week motivated them to keep up their daily practice. It also put the emphasis on home practice so that fewer office appointments were required than would otherwise be necessary.

Average weekly pre-practice HST functioned as an estimate of general levels of arousal and reflected a significant decrease in physiological arousal over a number of weeks of treatment. At the same time, average weekly post-practice HST reflected a gradual improvement in relaxation skill development. The average increase in pre-practice HST was associated with reports of a general feeling of calm and well-being, and a reduction of specific symptoms related to the end organs of the sympathetic nervous system. However, the self-reports of improvement by themselves are not surprising or unusual given the specific and non-specific effects of treatment. What is important, is that the changes in average weekly pre-practice temperatures over time increase the level of confidence that these self-report changes are ‘real’ and stable.

References


Sowder, Erik 2007 Autonomic function of patients with recurrent abdominal pain Dissertation Abstracts International: Section B: The Sciences and Engineering, 67(9-B), 5423.

