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Reduced Environmental Stimulation Therapy (REST) in anxiety and depression:

An experience sampling study

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Abstract

Background: Reduced Environmental Stimulation Therapy (REST) is a behavioral intervention that systematically attenuates external sensory input to the nervous system. Previous studies have demonstrated acute anxiolytic and antidepressant effects of single sessions of REST in anxious individuals, however the duration and time course of these effects is unknown. In the current study, we used experience sampling and multiple sessions of REST to explore the time course of the anxiolytic and antidepressant effects over a 48-hour time period.

Methods: 75 adults with anxiety and/or depression were randomized to complete 6 sessions of REST (either pool-REST, pool-REST preferred, or chair-REST). Post-REST effects were tracked using experience sampling on a smartphone with a ten-item survey administered at 6 time points for each session (i.e., immediately before and after REST and then 4, 8, 24, and 48 hours later).

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Declaration of Conflicting Interests

ACA. is founder of Insight Health Systems, Arevian Technologies, and Open Science Initiative. ACA. developed the Chorus platform, which is licensed from the University of California Los Angeles to Insight Health Systems. There are no other competing interests to report for any authors.

Ethics Statement

The study was approved by the Western Institutional Review Board under Protocol #20150528 and was performed in accordance with Declaration of Helsinki. All participants gave their written informed consent before participation and received compensation.

Clinical Trial Registration Identifier: NCT03899090

Using principal component analysis, responses to survey items at baseline were reduced to broad symptom clusters of anxiety, depression, and serenity and were utilized in linear mixed effects models to determine the magnitude and time course of post-REST effects.

Results: REST was associated with significant decreases in anxiety and depression, and significant increases in serenity, with effects lasting for 48 hours. Repeated exposure to REST was associated with lower baseline levels of anxiety at later sessions.

Conclusion: These initial findings suggest that the anxiolytic and antidepressant effects of REST persist for at least two days, and that repeated REST sessions may have additive effects on lowering anxiety-related symptoms. These findings could help to determine the optimal intervention frequency of REST and facilitate future investigations focused on the combination of REST with standard treatments for anxiety and depression.

Keywords

Reduced Environmental Stimulation Therapy; Floatation-REST; float therapy; anxiety disorder; major depressive disorder; ecological momentary assessment

Introduction

Reduced Environmental Stimulation Therapy (REST) is a poorly understood non-pharmacological stress-reduction intervention designed to systematically attenuate external sensory input to the nervous system [1]. Typically, REST involves floating effortlessly in a shallow pool of warm water that is saturated with Epsom salt (i.e., 'pool-REST'). Pool-REST environments are lightproof, soundproof, and humidity and temperature-controlled, such that signals from visual, auditory, olfactory, gustatory, thermosensory, tactile, vestibular, and proprioceptive channels are minimized, as is movement and speech. 'Chair-REST' is another form of REST that involves reclining in an ergonomically-engineered "zero-gravity" chair designed to take pressure off the spinal cord; the chair is placed in a room with dim lighting and quiet surroundings, similar but not identical to what would be experienced during pool-REST, thus serving as an active comparator.

Perhaps the most consistent clinical observation to date is that REST induces acute anxiolytic and antidepressant symptom reductions [2–5]. However, the precise duration and time course of these effects are unknown. Here, we explored the time course of acute REST effects using experience sampling over a 48-hour time period after six sessions, with additional exploratory analyses to understand the additive influence of repeated REST sessions on anxiety and depression symptoms.

Method

Participants

75 treatment-seeking adults with anxiety and/or depression, and elevated levels of anxiety (as measured by an OASIS score ≥ 6) and anxiety sensitivity (as measured by an ASI-3 total score ≥ 24) were recruited through LIBR's participant databases and from the Tulsa community. The full protocol and eligibility criteria are described elsewhere [6]. The study

was pre-registered (clinicaltrials.gov NCT03899090). All study procedures were approved by the Western IRB Protocol #20150528. All participants provided written informed consent before participation and received compensation.

Procedures

75 participants were randomized to 6 sessions of pool-REST (n=25), pool-REST preferred (n=25), or chair-REST (n=25). The time course of REST effects was assessed at 6 time points: before and after each REST session via iPad in the laboratory and then 4, 8, 24, and 48 hours later via text-message links sent to the participant's cellular phone using the web-based Chorus platform (Chorus Inc., Los Angeles CA).

The survey consisted of a ten-item questionnaire assessing symptoms known to be influenced by REST environments [3], including the PANAS-X Serenity subscale [7], Karolinska Sleepiness Scale [8], and continuous Visual Analogue Scales (VAS) assessing well-being, stress, depression, peacefulness, relaxation, and degree of muscle tension. All survey item values were converted into z-scores before analysis.

Experimental Conditions

Pool-REST—This involved 1-hour session durations prescribed at fixed 1-week intervals within an open or enclosed circular float pool with an 8-foot diameter (Floataway Inc., Norfolk, UK).

Pool-REST Preferred—This involved up to 2-hour session durations. Participants were allowed flexibility in arranging their floating sessions to match their preferred schedule within a 12-week period, with the only requirement being that there needed to be a minimum of 24 hours between sessions.

Chair-REST—This involved reclining in a Zero Gravity Chair (PC510, Classic Power, Series 2, Human Touch Inc., Long Beach, CA). This active comparator closely matched the pool-REST intervention on many parameters including a supine body position in a dimly lit and quiet room, a 1-hour session duration prescribed at fixed 1-week intervals, and a similar instruction set emphasizing the importance of stillness and wakefulness throughout each session.

Statistical Analysis

All analyses were performed in RStudio 3.6.0. Using a principal component (PC) analysis, responses to survey items at the initial pre-float session time point were reduced to broad symptom clusters using the Kaiser-Guttman criterion and visual inspection of scree plots. A promax rotation was applied to the retained PCs. Survey items that loaded most strongly onto each PC were assigned exclusively to that scale. Once PC scales were generated, individual item responses were converted to POMP scores (standardized units representing the "Percent Of Maximum Possible," ranging from 0–100%). Unit-weighted PC scales were then created by summing POMP scores for each respective component, and this was replicated for each of the subsequent survey timepoints. The resulting unit-weighted PC scales were utilized in independent linear mixed effects (LME) models to determine the

magnitude and time course of REST effects. A hypothesis-wise Bonferroni adjustment across the variables of interest was performed, whereby alpha was divided by the number of PCs extracted (α=0.05/3=0.017). LME modeling allowed for the examination of main effects of REST session, survey timepoint, and condition, and the interaction between these variables (i.e., *PC#~Survey*Session*Condition*). The models included subject ID and REST session as random effects (formula: *~1|Subject ID/Session*) and utilized an AR1 covariance structure. *Post hoc* two-sided t-tests with Holm corrections were used to interpret significant main effects and simple effects for all significant interactions.

Results

Participants

75 participants (mean age=35.0, SD=11.3, 77% female, 81% non-Hispanic White) were randomized. All participants had a DSM-5 diagnosis of an anxiety, stress-related, or depressive disorder, with the most common psychiatric diagnoses being major depressive disorder (97.3%) and generalized anxiety disorder (50.7%). At baseline, participants reported elevated anxiety and depression symptoms (average OASIS=9.7; average PHQ-9=12.1, respectively) and high anxiety sensitivity (average Anxiety Sensitivity Index-3=40.4). The groups did not differ significantly on any sociodemographic or clinical variables at baseline [6]. Of the 25 participants randomized to each group, the six session completer numbers were: 17 (chair-REST), 19 (pool-REST), and 21 (pool-REST preferred) [6].

Principal Component Analysis

The PC analysis suggested a three-component solution, with the top PCs (Eigenvalues: 4.43, 1.76, and 1.11) cumulatively accounting for 74% of the total variance. The top PCs in descending order of eigenvalue were designated: Serenity, Anxiety, and Depression, and accounted for 45%, 18%, and 11% of the total variance, respectively.

Magnitude and Duration of REST Effects

Anxiety—In the LME evaluating self-reported anxiety, a significant main effect of survey ($F(5)=94.30$, $p<0.001$, $\eta_p^2=0.25$) and REST session ($F(5)=5.10$, $p=0.0002$, $\eta_p^2=0.09$), and a significant interaction between survey and condition ($F(10)=2.88$, $p=0.0015$, $\eta_p^2=0.02$) was observed. *Post hoc* comparisons revealed reductions in self-reported anxiety lasting 48 hours across all three REST interventions ($ps\leq0.01$, *Cohen ds (d)*=0.47–1.64; Figure 1). Additive effects on anxiety levels were observed with significantly lower anxiety at sessions 5 ($p=0.0453$, $d=0.30$) and 6 ($p=0.0112$, $d=0.35$) versus session 1 (Figure 1).

Depression—In the LME evaluating self-reported depression, a significant main effect of survey ($F(5)=87.96$, $p<0.0001$, $\eta_p^2=0.23$), and a significant interaction between survey and condition ($F(10)=2.29$, $p=0.0116$, $\eta_p^2=0.02$) was observed. *Post-hoc* comparisons revealed significant reductions in self-reported depression lasting 48 hours for the pool-REST preferred intervention ($ps<0.001$, *ds*=0.52–1.64) but only up to 8 hours in the chair-REST ($p=0.0001$, $d=0.65$) and pool-REST interventions ($p=0.0002$, $d=0.57$; Figure 1).

Serenity—In the LME evaluating self-reported serenity, a significant main effect of survey ($F(5)=198.62$, $p<0.0001$, $\eta_p^2=0.41$) and a significant interaction between survey and condition ($F(10)=2.50$, $p=0.006$, $\eta_p^2=0.02$) was observed. *Post hoc* comparisons revealed significantly higher levels of serenity for 24 hours for the chair-REST intervention ($ps \leq 0.01$; $ds=0.50–1.71$) and 48 hours across the pool-REST and pool-REST preferred interventions ($ps \leq 0.01$; $ds = 0.38–2.38$; Figure 1).

Discussion

This exploratory study examined the time course of the acute effects of REST in anxious and depressed adults. Significant reductions in anxiety and depression and increases in serenity were observed, lasting up to 48 hours post-session. REST also had cumulative effects whereby lower anxiety symptoms were reported prior to the fifth and sixth sessions. These preliminary findings indicate that REST can provide persistent short-term affective symptom relief, suggesting its potential as a viable non-pharmacological intervention to be evaluated further.

Our results inform decisions regarding the optimal number and duration of REST sessions for future randomized clinical efficacy trials. Specifically, a 48-hour window captured most of the acute changes in anxious and depressed mood ratings. Setting a minimum 48-hour interval between REST sessions would thus seem feasible for a study attempting to induce a more sustained form of anxiolysis. While the acute reductions in anxiety and depression were followed by some increases, the overall symptom reductions remained below baseline levels at the 48-hour timepoint. Thus, the upper limit of this clinical window remains uncharacterized. The additive anxiolytic effects observed at sessions five and six indicate that future REST studies should evaluate the impact of a larger number of sessions. It is currently unclear whether such additive effects would continue to grow with additional sessions, although this may be why prior REST studies have employed larger session numbers (e.g., ranging from 9 to 33 sessions) [4, 5].

Several limitations must be acknowledged. The small sample size was not adequately powered for a between-group analysis of pool- vs. chair-REST (i.e., active comparator) effects in this open label exploratory study, nor was a placebo or sham intervention arm included. It is presently difficult to pinpoint the mechanism of the persistent effects of REST despite previously observed impacts on peripheral and central autonomic targets [9, 10]. Although the survey items used in this study were extracted from standardized scales with acceptable psychometric properties [7, 8] for the ESM approach, they do not replace clinical rating scales. Finally, the longer-term clinical effects of repeated sessions of REST remain uncharacterized in anxious and depressed individuals.

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Data Availability Statement

Requests for sharing of data used in this analysis can be made to the corresponding author. Any sharing of data will be subject to obtaining appropriate agreements from the principal investigators or data custodians.

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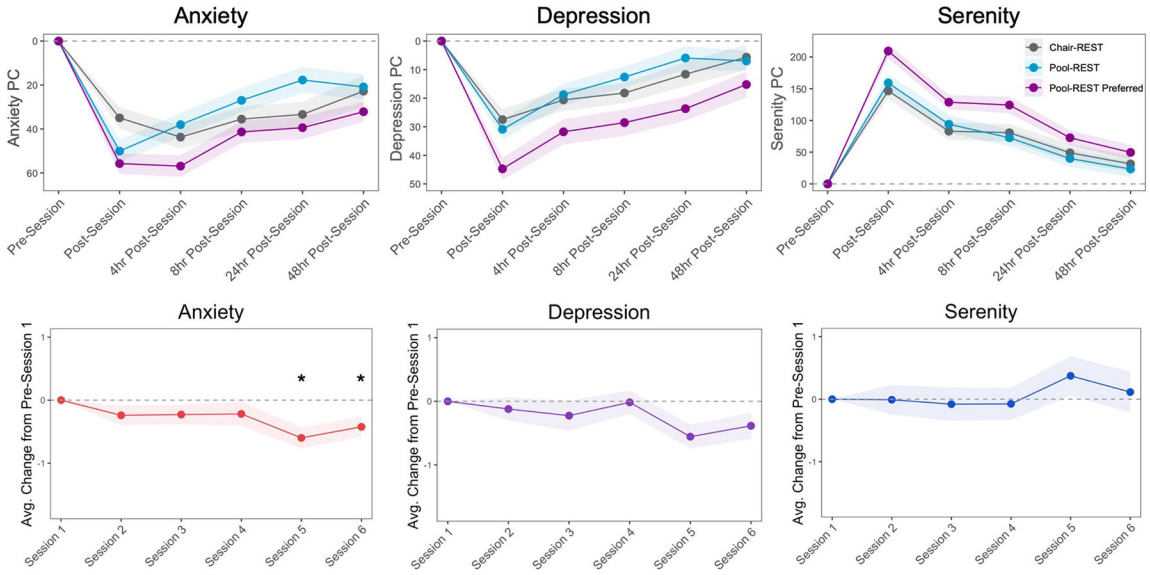

Figure 1.

Top: Time course of average REST effects across six sessions. Significant reductions in anxiety lasted for 48 hours across all three REST conditions. Significant decreases in depression were present for 48 hours for the pool-REST preferred condition and up to 8 hours for the chair-REST and pool-REST conditions. Significant increases in serenity ratings were present at all time points for both pool-REST conditions but were no longer present at 48 hours for the chair-REST condition. **Bottom:** Additive effects of REST. Pre-session anxiety at visits 5 and 6 was significantly lower than pre-session anxiety ratings at visit 1. There were no significant additive effects for depression or serenity. Ribbons reflect the standard error of the mean. PC: Principal Component. REST: Reduced Environmental Stimulation Therapy.