Restricted Environmental Stimulation Therapy for Concussion Treatment (RESTCON): a pilot study

S Moore DO [1] , H Emerson MD [2,3] , C Madsen MD MS [2,4]

1 Department of Medical Laboratory Sciences, Weber State University, Ogden, UT

2 Department of Family Medicine, McKay-Dee Family Medicine Residency Program, Ogden, UT

3 Family Medicine, Tanner Clinic, Roy, UT

4 Team Physician, Weber State University, Ogden, UT

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Keywords: REST, sensory deprivation, concussion, mTBI, post-concussion syndrome

Biographical Note:

Scott Moore; academic clinical pathologist and professor of medical laboratory sciences Clark Madsen; academic sports medicine physician and family medicine residency faculty Haleigh Emerson; community family medicine physician

ABSTRACT:

Objective: Evaluate Restricted Environmental Stimulation Therapy (REST) use in acute or chronic concussion. **Design:** Prospective cohort study with two cohorts; acute (<6 weeks) and chronic (≤6 weeks) concussions. Subjects underwent 3 sessions of REST within 10 days monitoring symptoms before and after therapy. **Setting:** University and community sports medicine clinics. **Participants:** 8 patients with acute (N=5) and chronic (N=3) concussions between 18-59 years of age were recruited. **Main outcomes measured:** Symptom scores (SCAT-5) before and after REST sessions and a post-study survey. **Results:** Symptom scores decreased by an average of 18.8 points (±6.9, p =0.01) from pre- to post-float and dropped an average of 9 points (p =0.02) between sessions. Patients were universally positive about their REST experience. Nausea was the most common adverse event (N=2) and all subjects responded that they recommended REST for concussion treatment after completing the study. **Conclusions:** REST has the potential for symptomatic relief for patients with acute or chronic concussions. Further testing is required to determine the magnitude of effect, duration of symptom relief, and optimal frequency of REST.

Key words: REST, sensory deprivation, concussion, mTBI, post-concussion syndrome.

INTRODUCTION:

Concussion treatment has evolved greatly over the past decade [1,2] . Further understanding of how injury occurs and how the brain recovers has led to numerous treatment modalities and protocols. Despite this, the mainstay of concussion treatment involves varying levels of rest, both cognitive and physical. Few studies have shown definitive recovery benefits from active interventions such as medication, activity, or therapy [3,4] . It is clear that excessive activity early on can worsen a patient's concussion symptoms in the short term [5] . This has created an environment where active forms of rest could have an impact on patient recovery.

Restricted Environmental Stimulation Therapy (REST) has been a treatment used for decades with studied effects on addiction, anxiety, muscular pain, and pain tolerance but not on traumatic head injuries. Despite this, anecdotal reports from local football players who use REST were overwhelmingly positive. REST, also known as sensory deprivation tanks or "float tanks", involves subjects laying in a specialized pod with a

shallow pool of warm water containing Epsom salt (magnesium sulfate), Figure 1. The subject floats on top of the water and the sensations of temperature, sound, vision, and touch are all dampened. With minimal stimulation, subjects will often fall into a state of deep relaxation. We hypothesize that reducing stimulation and allowing for deep relaxation can have a positive effect on concussion symptoms.

METHODS:

The study protocol was approved by the IRB of Intermountain Healthcare and Weber State University. Subjects were 18 years or older and had a SCAT-5 graded symptom score of at least 20. Individuals with epilepsy, chronic renal disease (concern for magnesium absorption), severe claustrophobia, or severe traumatic brain injury were excluded. Subjects were recruited from a Sports Medicine clinic after clinical diagnosis of acute concussion (cohort 1) or chronic concussion, with symptoms lasting greater than 6 weeks (cohort 2). At enrollment, the subjects followed the pathway outlined in Figure 2 and were scheduled for 3 sessions of REST within a 10-day period. They also completed a symptom checklist (SCAT-5) before and after each REST session. After 6 weeks or resolution of their concussion symptoms, the subjects completed a final questionnaire regarding their experience with REST.

An a priori power analysis could not be performed as this therapy has not been used in published studies to date. The primary outcome for the study is the symptom score difference between the pre- and post-REST symptom checklist. Differences will be evaluated using paired Student's T-test and linear regression analysis to control for other variables. Secondary outcomes of interest include differences related to acute or chronic concussion symptoms, the effect of repeated floats, and demographic effects.

RESULTS:

Eight subjects were enrolled; five with acute and three with chronic symptoms. One subject was not included in the analysis as he enrolled in the study and subsequently was lost to follow-up despite numerous attempts to contact. He did not complete any REST sessions. Demographic information on the remaining subjects enrolled is found in Table 1. There was an average 18 point drop in symptom score from the pre- to post-REST assessment on the paired t-test ($p<0.001$). There was no significant difference seen in outcomes between the two cohorts, though this is likely limited based on sample size.

In linear regression analysis, there was also an 18 point average drop in the symptom score from before to after the float ($p=0.008$). This was concluded after controlling for days since injury, hours of sleep the previous night, and number of sessions performed. The number of sessions was also a significant predictor with the average symptom score dropping 9 points per session ($p=0.02$), Figure 3. Demographics including age, gender, chronicity of symptoms, and number of previous concussions were not included as they were not found to be significant and did not contribute to the analysis.

A post-study survey of attitudes toward REST showed that all participants felt that they would recommend REST to a friend with a concussion. Most REST sessions had no adverse effects to report (76%). Two subjects had some nausea on their first session but not on others. One patient with preexisting anxiety had some mildly elevated anxiety in all three sessions, One subject expressed a few minutes of vertigo at the beginning of her third session but this resolved spontaneously. Interestingly one subject with acute concussion stated that REST also helped her neck and back pain, while one subject with chronic concussion noted that her neck and back pain were mildly worse during REST.

DISCUSSION:

All patients said that they would use floatation therapy again, would recommend it to a friend, and objectively felt better, with a lower post-REST symptom score compared to pre-REST. The effect increased progressively as the subjects completed more floats. This cannot be solely attributed to REST as acute concussion patients are known to improve over time without treatment. Future studies will be needed to determine whether REST reduces the time to recovery or only temporarily reduces the symptom load.

An average of 18 point improvement in the SCAT-5 symptom score is clinically significant in the eyes of the authors and is recognized by the subjects who answered that they felt better after 86% of REST sessions.

Patients with chronic concussions had higher average symptom scores, more preexisting comorbidities, and were found to sleep fewer hours, which was expected based on prior work [6,7]. This study was unable to show a difference in effect for those with chronic or acute concussion symptoms but the mean symptom score dropped by 25 and 14 points in acute and chronic concussions respectively. The effect size of REST may be understated in this study as many subjects were reaching zero or near zero symptoms by the time they finished the REST session and thus dampened the potential effect. Changes in individual symptoms are shown in Figure 4 but should be evaluated with caution as the study was not powered to show differences between individual symptoms.

Our study found some mild adverse effects to be considered including mainly involving nausea and anxiety. In these situations the symptoms were mild and present prior to the REST session. Further study is needed to determine the frequency of these and other adverse effects.

The study was concluded early by IRB recommendation due to the COVID-19 pandemic. It was also halted as a pattern of clear benefit was emerging and transition to a more rigorous randomized control trial is warranted. Future work will need to compare REST to other forms of relaxation and stimulus reduction, determine the optimal frequency and duration of treatment, and identify candidates most likely to benefit from the treatment. This study looked at the immediate effect of REST on symptoms and cannot make any comment on whether REST can decrease time to symptom resolution or return to activity.

CONCLUSION:

REST in concussion appears to provide at least temporary relief from concussion symptoms. In this small cohort study a clear pattern of benefit has emerged. Further study is encouraged as REST does have the potential to become a standard treatment for concussion.

REFERENCES:

1. Moser RS, Glatts C, Schatz P. Efficacy of immediate and delayed cognitive and physical rest for treatment of sports-related concussion. J Pediatr. 2012;161(5):922-926. https://doi.org/10.1016/j.jpeds.2012.04.012

2.Laura K Purcell, Canadian Paediatric Society, Healthy Active Living and Sports Medicine Committee, Sport-related concussion: Evaluation and management, Paediatrics & Child Health, Volume 19, Issue 3, March 2014, Pages 153–158, https://doi.org/10.1093/pch/19.3.153

3. Leddy JJ, Wilber CG, Willer BS. Active recovery from concussion. Curr Opin Neurol. 2018;31(6):681-686. https://doi.org/10.1097/WCO.0000000000000611

4. Collins MW, Kontos AP, Okonkwo DO, et al. Statements of Agreement From the Targeted Evaluation and Active Management (TEAM) Approaches to Treating Concussion Meeting Held in Pittsburgh, October 15-16, 2015. Neurosurgery. 2016;79(6):912-929. https://doi.org/10.1227/NEU.0000000000001447

5. Brown NJ, Mannix RC, O'Brien MJ, Gostine D, Collins MW, Meehan WP., 3rd Effect of cognitive activity level on duration of post-concussion symptoms. Pediatrics. 2014;133(2):e299–304.

6. Chung, J. S., Zynda, A. J., Didehbani, N., Hicks, C., Hynan, L. S., Miller, S. M., … Cullum, C. M. (2019). Association Between Sleep Quality and Recovery Following Sport-Related Concussion in Pediatrics. Journal of Child Neurology, 34(11), 639–645. https://doi.org/10.1177/0883073819849741

7. Raikes AC, Schaefer SY. Sleep Quantity and Quality during Acute Concussion: A Pilot Study. Sleep. 2016;39(12):2141-2147. Published 2016 Dec 1. https://doi.org/10.5665/sleep.6314

8. McClure, D. J., Zuckerman, S. L., Kutscher, S. J., Gregory, A. J., & Solomon, G. S. (2014). Baseline Neurocognitive Testing in Sports-Related Concussions: The Importance of a Prior Night's Sleep. The American Journal of Sports Medicine, 42(2), 472–478. https://doi.org/10.1177/0363546513510389

FIGURE 1 : REST "Float pod"

Typical float pod used for this study. The water is 10 inches deep, contains approximately 960lbs of Epsom salt, and is heated to 35° Celsius (94° F).

i-float sensations

FIGURE 2 : RESTCON study patient pathway

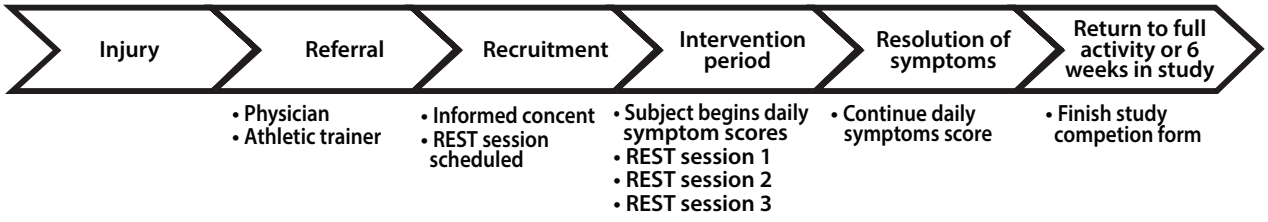

FIGURE 3 : Average symptom score by REST session
Except for one outlier all sessions resulted in a lower symptom score than initial presentation.
Symptom scores did improve from session to session as well.

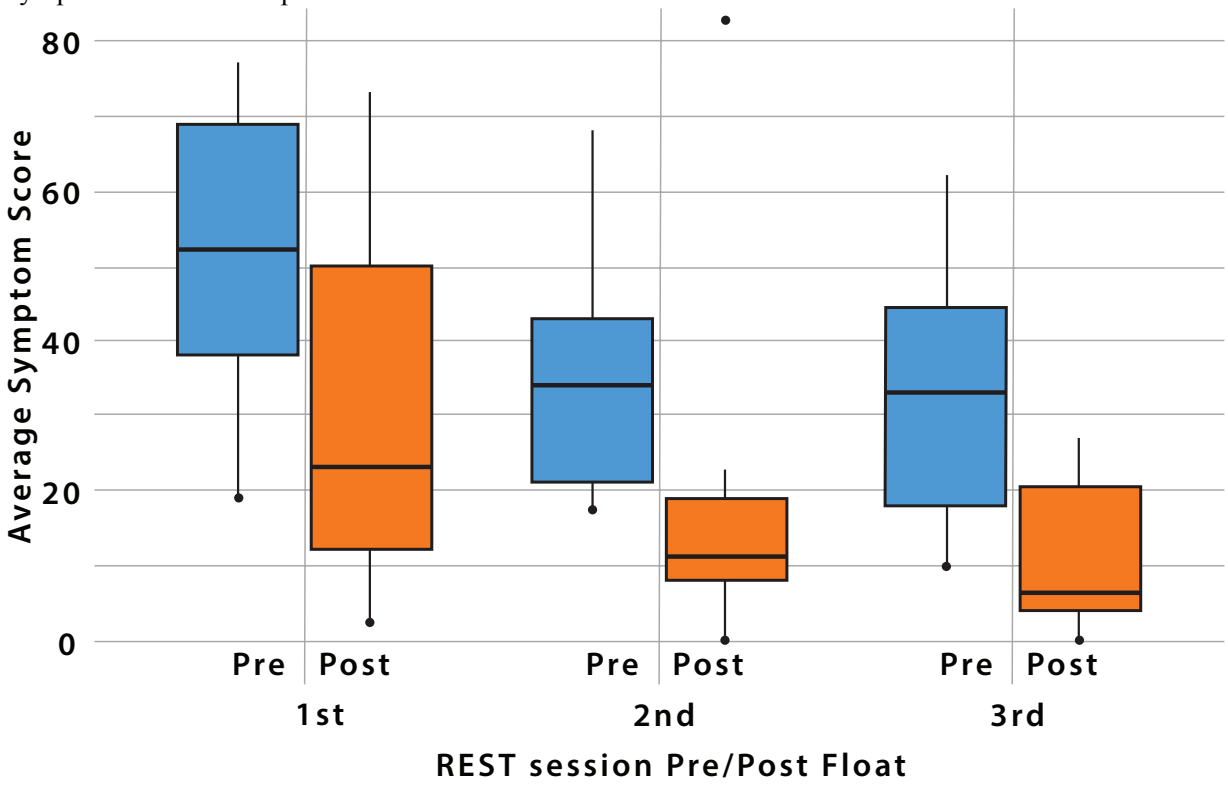

FIGURE 4: Individual symptoms pre/post REST.
SCAT-5 graded symptom scale. Most symptoms improved after REST. T-test was used for comparison.
(*) $p<0.05$, (**) $p<0.01$.

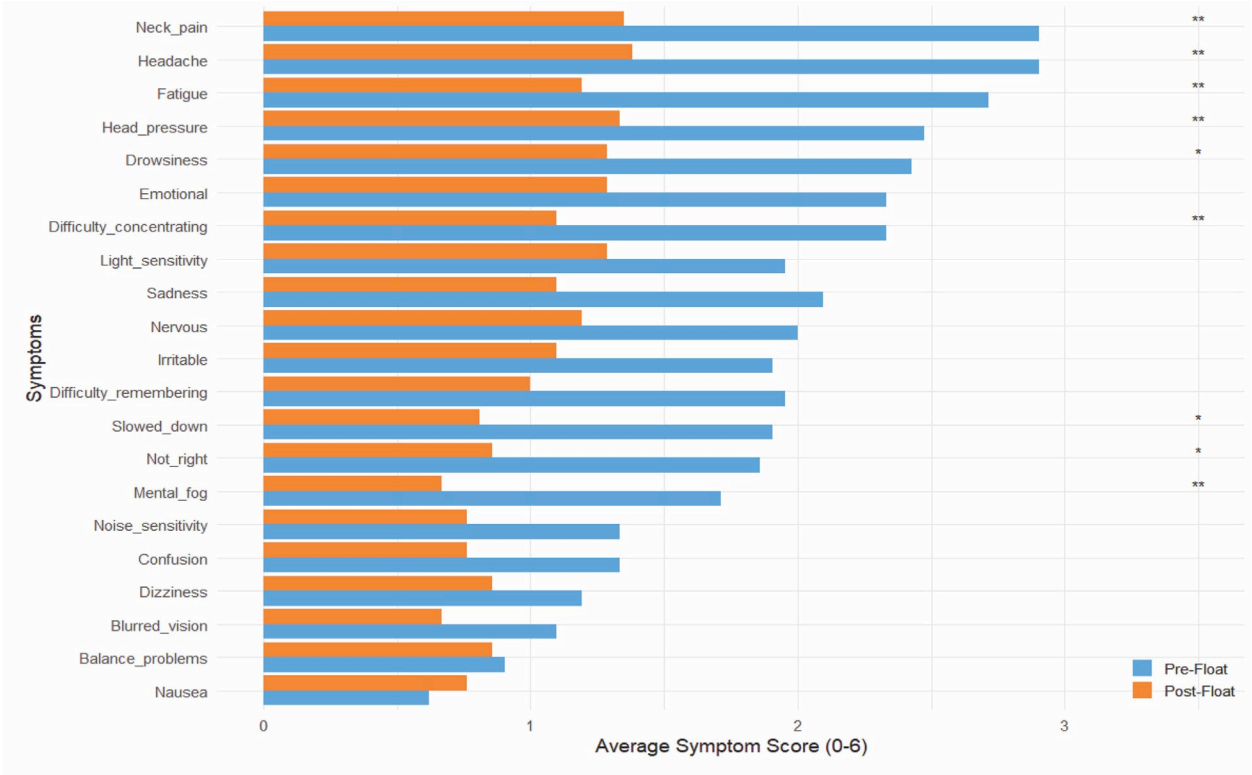

Table 1: Demographic Information

	Median	Range
Age	37	18-59
Previous concussions	1	0-12
Baseline Symptom Score	52	20-77
	Percentage	
Female	86%	

Concussion Etiology	Percentage
Motor vehicle accident	71%
Sports	29%
Pre-existing comorbidities	0
ADHD/Learning disorder	14%
Mental health condition	43%
Migraines	43%

i-Float Sensations LLC, 1490 e 5600 s, Suite 2, South Ogden, UT 84403 Ph: 801.888.6777
www.ifloatOgden.com

R.E.S.T. Floatation Therapy Protocol for TBI or Concussion treatment with possible physical pain/injury

i-Float Sensations does an initial consultation prior to the first REST session and again after.

Please call in to book a brief consultation session at no extra charge.

Total 4 initial floats in a two week period.

Week 1 - (3) 1-hour float sessions

Week 2 - if symptoms come back (1) 1-hour float session

Week 3 and beyond Float as needed or at least once a month

After the initial 3 sessions another consultation is done.

An additional consultation may be done as week 2 protocol comes to an end.

We recommend at least one float a month or more as needed after week 3.

Notes:

For any kind of TBI and/or Concussion it is important to float as soon as possible after the initial injury and follow all doctor prescribed protocols. Symptoms will deplete substantially after each float session but will come back to a lesser degree the next morning. It is important to do the 3 float sessions as outlined above with the 4th float as an option if some symptoms still linger.

Don't eat for at least 2 hours prior to floating.

Take any medication at least 4 hours prior to floating.

Better to come in slightly dehydrated or least don't drink a lot of liquid prior.

Do not float if you have any severe cuts or open wounds.