Evaluating the Effectiveness of Mindfulness Meditation for Chronic Musculoskeletal Pain in U.S. Veterans Using the Defense and Veterans Pain Rating Scale (DVPRS)

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INTRODUCTION

- This pilot study evaluated the effectiveness of mindfulness meditation (MM) for managing chronic pain in U.S. military veterans who have sustained a traumatic brain injury (TBI) during deployment to Afghanistan (OEF) or Iraq (OIF). Musculoskeletal pain conditions are the most frequently diagnosed health condition in this military cohort, exceeding any other medical or psychological concern (1, 2).
- Chronic pain is also highly comorbid in veterans who have sustained a TBI in theater, with up to 75% exhibiting both conditions concurrently (3). The prevalence of chronic pain and TBI supports the need to investigate effective treatments and assessment methods for patients with these two health conditions.
- Integrative Restoration Yoga Nidra (iRest®), a type of MM, is a Tier I intervention for managing pain in military and veteran populations (4) and is used clinically at VHA medical centers nationwide. Developed by Dr. Richard Miller, iRest promotes deep relaxation through breathing, guided imagery, and progressive relaxation techniques. This is the first study to research iRest as an intervention for chronic pain.
- Three metrics were used to assess self-reported pain: Visual Analogue Scale (VAS), Brief Pain Inventory (BPI) and Defense and Veterans Pain Rating Scale (DVPRS). The VAS exclusively measures pain intensity, whereas the BPI and DVPRS assess both pain intensity (referred to as "pain severity" for the BPI) and pain interference.
- The DVPRS was recently developed for use in military and veteran populations to provide more descriptive pain data than the commonly used numeric rating scale (NRS). The DVPRS measures pain intensity using an NRS enhanced by visual cues and verbal descriptors to improve interpretability of incremental pain intensity levels (Figure 1). The DVPRS also includes 4 supplemental questions to assess perceived interference of pain with general activity, sleep, mood and stress (Figure 2). Limited information exists regarding the validity of the DVPRS (5). To our knowledge this study represents the first use of the DVPRS in a research setting.
- This study examined whether iRest, as an adjunctive therapy to standard medical care, relieves chronic pain more effectively than standard care alone. Based on previous research supporting the benefits of MM on chronic pain (6, 7), we hypothesized that iRest practice would result in lowered pain intensity and pain interference as measured by the previously listed instruments.

METHODS

- Study participants were recruited at the Washington, DC Veterans Affairs Medical Center (DC VAMC). IRB and R&D Committee approvals were granted. Inclusion criteria included age of 20-60 years old, male gender, deployment to OEF/OIF, mild or moderate TBI, and self-reported pain ≥ 5 out of 10 on the NRS. Exclusion criteria were alcohol consumption > 3oz/day, illicit substance use, or prescription medications that could influence pain perception (over the counter analgesics were permitted).
- Of 118 patients who expressed interest in the study, 57 did not meet eligibility criteria, 48 were unable or unwilling to participate, and 13 Veterans were randomly assigned to receive 8 weeks of iRest (case group) or standard care alone (control group). Most participants were receiving "standard care" as an outpatient at the DC VAMC from their primary care provider, psychologist, and audiologist. Due to attrition, 4 case and 5 control group participants were included in the data analysis.
- Pain measures were administered at baseline (week 0), midpoint (week 4), endpoint (week 8), and follow-up (week 12).
  1. The VAS measures pain intensity by having patients draw a mark on a 10-cm line to indicate their level of pain 'right now' from 'no pain' (0 mm) to 'worst pain imaginable' (100 mm).
  2. The BPI assesses pain severity on 4 scales: a) 'pain at its worst' b) 'pain at its least' c) 'pain on average' and d) pain 'right now' (BPI-SEV). Pain interference on the BPI assesses a) general activity, b) mood, c) walking ability, d) normal work, e) relations with other people, f) sleep, and g) enjoyment of life (BPI-INT). The numbers for each group are averaged together to yield a mean score for pain "severity" and "interference."
  3. The DVPRS uses a pain intensity scale (DVPRS-NRS) and 4 supplemental scales that are averaged together to yield a mean value for pain interference (DVPRS-INT).
- A 20% reduction in pain was considered clinically significant, which was recognized by The Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT) as a minimally important change in chronic pain intensity (8). Moderately and substantially important changes are associated with 30% and 50% reductions, respectively.

RESULTS

- Pain evaluation data collected by a neurologist pain specialist at the DC VAMC (Figure 3) shows that baseline pain symptoms reported by patients in both groups (n=9) were primarily musculoskeletal, located in the low back (n=7), knees (n=5), neck (n=3), hips (n=2), and shoulders (n=2). Most participants experienced pain in more than one region, with the majority reporting two distinct regions (n=4), followed by three (n=2) and four (n=2) different areas of pain. Two patients had a partially contributing neuropathic pain component, in the form of lumbar radiculopathy.
- Pain intensity decreased from baseline to endpoint (B-E) and also from baseline to follow-up (B-F) for the case group on the DVPRS-NRS (Figure 4), BPI-SEV, and VAS. The percentage reduction in these pain ratings for the case group was greater than for the control group across all measures (Table 1).
- All decreases in pain intensity for the case group were of minimal (20-30%) or moderate (>30%) clinical importance, whereas the control group never achieved a minimally significant change in pain intensity (<20%). Case group pain reductions for the DVPRS-NRS from B-E (26.92%) were sustained at follow-up (26.92%), but were only partially maintained for the VAS (42.44% B-E and 22.51% B-F) and BPI-SEV (23.58% B-E and 9.43% B-F). The only pain intensity decrease to achieve statistical significance, according to paired t-tests, was the VAS from B-F (p=.041; Table 2).

Defense and Veterans Pain Rating Scale

Figure 1. DVPRS Pain Intensity Measure

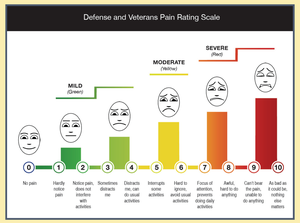


Figure 2. DVPRS Pain Interference Measure

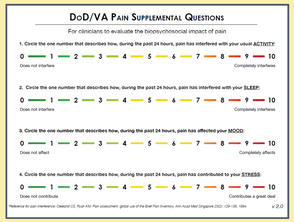
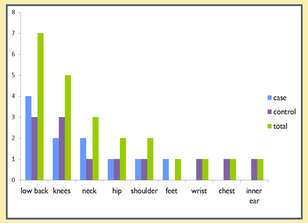
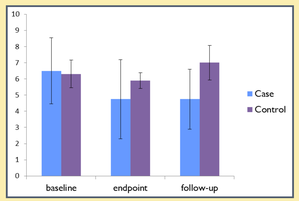


Figure 3. Patient Reports of Pain at Baseline



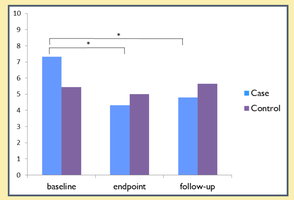
Results

Figure 4. Mean Pain Intensity on the DVPRS



Note. Error bars indicate the 95% confidence intervals.

Figure 5. Mean Pain Interference on the DVPRS



Note. Error bars indicate the 95% confidence intervals. * = significant result (p<.05).

Figure 6. Pain Interference of Individual Patients for the DVPRS (Case Group)

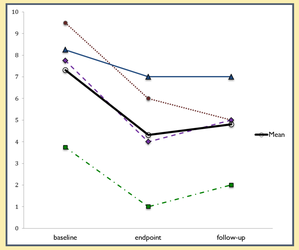


Figure 7. Mean Pain Interference by Subscale of the DVPRS (Case Group)

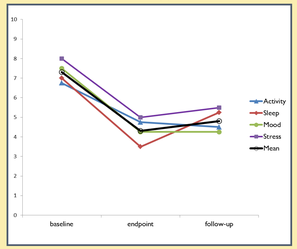


Table 1. Percentage Reduction in Pain Scores

Baseline to Endpoint (B-E) and Baseline to Follow-up (B-F)

Pain measure	Time	Case	Control
Visual Analog Scale	B-E	42.44%	17.19%
	B-F	22.51%*	1.88%
DVPRS Pain Intensity	B-E	26.92%	6.35%
	B-F	26.92%	-11.11%
BPI Severity	B-E	23.58%	4.88%
	B-F	9.43%	-13.82%*
DVPRS Interference	B-E	41.06%*	8.26%
	B-F	34.22%*	-3.67%
BPI Interference	B-E	32.72%*	7.07%
	B-F	33.65%*	4.16%

Note. Positive percentages represent mean reductions in pain and negative percentages are mean increases in pain. Minimally and moderately important changes in pain are defined as 20-30% and >30%, respectively (Dworkin et al., 2008). *p<.05 according to paired *t*-tests.

Table 2. Paired t-test Results

Measure	Time	Group	*n*	*M*	*SD*	*t*	*df*	*p*	d_z	d_z
Visual Analogue Scale	B-E	CASE	4	28.75	25.68	2.24	3	.111	1.19†	0.62
		CONTROL	5	11.00	19.14	1.29	4	.268		
	B-F	CASE	4	15.25	8.85	3.45	3	.041*	0.77	0.68
		CONTROL	5	1.20	9.09	0.295	4	.783		
DVPRS Intensity	B-E	CASE	4	1.75	1.50	2.33	3	.102	0.77	0.68
		CONTROL	5	0.40	1.14	0.78	4	.477		
	B-F	CASE	4	1.75	1.71	2.05	3	.133	0.88†	0.42
		CONTROL	5	-0.70	0.67	-2.33	4	.080		
BPI Severity	B-E	CASE	4	1.56	1.49	2.10	3	.127	0.80†	0.47
		CONTROL	5	0.30	0.97	0.69	4	.529		
	B-F	CASE	4	.63	1.05	1.19	3	.320	0.40	0.67
		CONTROL	5	-0.85	0.29	-6.67	4	.003*		
DVPRS Interference	B-E	CASE	4	3.00	1.14	5.28	3	.013*	1.21†	0.41
		CONTROL	5	0.45	1.59	.631	4	.562		
	B-F	CASE	4	2.50	1.32	3.78	3	.032*	1.09†	0.42
		CONTROL	5	-0.20	1.46	-.306	4	.775		
BPI Interference	B-E	CASE	4	2.46	1.50	3.28	3	.047*	1.06†	0.13
		CONTROL	5	0.41	1.42	0.65	4	.549		
	B-F	CASE	4	2.54	0.94	5.42	3	.012*	1.30†	0.26
		CONTROL	5	0.24	0.33	1.63	4	.179		

Note. *M*=mean difference, *SD*=standard deviation of the mean difference, *df*=degrees of freedom, *t*=*T*-value (two-tailed at significance level p<0.05), *d*=Cohen's d. d_z is the effect size of the pre-post difference within the case group only. d_z is the effect size of the difference between case group and control group at endpoint or follow-up.*p<.05; † = large effect size ($d \geq 0.80$).

- Individual ratings for the DVPRS-INT shown in Figure 6 illustrate that case group participants predominantly followed a similar pattern, decreasing in pain interference from B-E and slightly regressing at follow-up. All reductions in pain interference for the case group were statistically significant (p<.05; Table 2; Figure 5). The interference subscales of the DVPRS (activity, sleep, mood, stress) all decreased from B-E and these improvements were sustained at follow-up, with the exception of sleep (Figure 7). For the control group, changes in pain interference across measures and time points were not clinically significant (<10%; Table 1) or statistically significant (Table 2).
- Table 2 shows that large effect sizes were observed for all pain interference measures and time points, pre to post, in the case group (d_z=1.06–1.30). In comparison, pain intensity measures tended to be smaller in size (d_z=0.40–1.19). Effect sizes between groups at endpoint and follow-up were primarily medium in size for pain intensity (d_z=0.47–0.68) and small for pain interference (d_z=0.13–0.42).

CONCLUSION

- Findings from this pilot study lend support for the potential effectiveness of iRest for managing chronic pain after TBI and for the reliability of the DVPRS for assessing pain in a small veteran sample. For both the DVPRS and BPI, moderately important and statistically significant reductions in pain interference were observed in veterans receiving iRest. The results across pain measures in this study (9.43% – 42.44%; Table 1) were comparable with pain intensity reductions reported in other MM studies (11.8% – 49.4%) (6).
- Greater beneficial effects were observed for pain interference than pain intensity among participants receiving iRest. We found substantial decreases in pain interference (32.72% – 41.06%; Table 1) accompanied by large effect sizes between time points (0.92 – 1.13; Table 2). However, only minimally to moderately important differences in pain intensity were found, which were associated with small to medium effect sizes.
- Although pain assessment routinely involves the VAS and NRS, psychological factors such as the interference of pain with daily life are important in evaluating an individual's perception of the pain and the ability to regulate their experience of pain (9). Therefore, pain interference should be an important component of pain assessment in clinical and research settings. Pain interference may also be a more appropriate measure for evaluating the effectiveness of MM interventions, due to their emphasis on acceptance (7) and sustaining attention on pain sensations without evoking unpleasant thoughts or emotions (6).
- Study limitations include the small sample size and low statistical power, which challenges the validity of the results. In addition, these findings cannot be easily generalized to chronic pain patients a) receiving care outside the VHA system, b) without comorbidities such as TBI, and c) of female gender. This feasibility study focused on male veterans, because a considerable increase in research sites would have been required to control for gender-specific variability in pain perception.
- Despite these shortcomings the findings from this pilot study are encouraging, and highlight the therapeutic potential of a novel approach for those living with chronic pain after TBI. Further research is warranted on larger samples to study the validity of the DVPRS and confirm the effectiveness of iRest for managing chronic pain.

REFERENCES

1. Kerns, R. D., & Dobscha, S. K. (2009). Pain among veterans returning from deployment in Iraq and Afghanistan: update on the Veterans Health Administration Pain Research Program. Pain Med, 10(7), 1161-1164.
2. Spelman, J. F., Hunt, S. C., Seal, K. H., & Burgo-Black, A. L. (2012). Post deployment care for returning combat veterans. J Gen Intern Med, 27(9), 1200-1209.
3. Nampiaparampil, D. E. (2008). Prevalence of chronic pain after traumatic brain injury: a systematic review. JAMA, 300(6), 711-719.
4. Pain Management Task Force. (2010). Final Report. Retrieved from http://www.health.mil/dhb/downloads/07_Pain_Management_Buckenmaier.pdf
5. Buckenmaier, C. C., 3rd, Galloway, K. T., Polomano, R. C., McDuffie, M., Kwon, N., & Gallagher, R. M. (2013). Preliminary validation of the Defense and Veterans Pain Rating Scale (DVPRS) in a military population. Pain Med, 14(1), 110-123.
6. Reiner, K., Tibi, L., & Lipsitz, J. D. (2013). Do mindfulness-based interventions reduce pain intensity? A critical review of the literature. Pain Med, 14(2), 230-242.
7. Veehof, M. M., Oskam, M. J., Schreurs, K. M., & Bohlmeijer, E. T. (2011). Acceptance-based interventions for the treatment of chronic pain: a systematic review and meta-analysis. Pain, 152(3), 533-542.
8. Dworkin, R. H., Turk, D. C., Wyrwich, K. W., Beaton, D., Cleeland, C. S., Farrar, J. T., et al. (2008). Interpreting the clinical importance of treatment outcomes in chronic pain clinical trials: IMMPACT recommendations. J Pain, 9(2), 105-121.
9. Zeidan, F., Grant, J. A., Brown, C. A., McHaffie, J. G., & Coghill, R. C. (2012). Mindfulness meditation-related pain relief: evidence for unique brain mechanisms in the regulation of pain. Neurosci Lett, 520(2), 165-173.

ACKNOWLEDGEMENTS

This research was funded in part by American University through a Doctoral Student Research Award, and the Washington, D.C. Veterans Affairs Medical Center (DC VAMC) with financial support provided by the War Related Illness & Injury Study Center in Washington, DC (WRIISC-DC) and Voluntary Service and Recreation Therapy at the DC VAMC. The authors would like to thank Dr. Matthew J. Reinhard, Director, WRIISC-DC, and Stephanie Burns, Chief, Voluntary Service and Recreation Therapy for provision of resources.