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RESPIRONICS

PTSD

White paper

Actigraphy in post traumatic stress disorder

Author: Krishna Jhaveri, MD, PhD; Senior Clinical Scientist, Philips Sleep and Respiratory Care

Posttraumatic stress disorder (PTSD) is estimated to affect approximately 10% of women and 5% of men in the United States at some point in their lives¹. Clinically significant levels of sleep disturbances, a core feature of PTSD^{2,3}, was noted in nearly 70% of individuals with PTSD^{4,5}. PTSD has been associated with: a) reduced sleep efficiency, b) increased sleep latency, c) increased sleep fragmentation, and d) greater night-to-night variability in sleep^{2,6-10}.

The relationship between PTSD and sleep disruption is complex. Sleep patterns of those with PTSD likely fluctuate over time depending on the chronicity of PTSD, nature of trauma, comorbid conditions, and medication usage. Actigraphy is thus ideally suited to studying these patterns as it is precise, non-invasive, objective, and provides continuous data over periods of weeks or months. Subjective reports of sleep complaints are common in PTSD, however, results of objective measures from polysomnographic (PSG) and actigraphy studies are inconsistent. Some studies examining objective measures of sleep in PTSD have not found substantial sleep abnormalities^{6,11}, whereas others have detected a variety of differences in various sleep parameters between individuals with and without PTSD (e.g. 12-14). Additionally, data from several PSG and actigraphy-based studies suggest that individuals with PTSD often report sleep disturbances in the absence of any demonstrable disruption in objectively measured sleep, highlighting the divergence of self-reported and objective measurements of sleep¹⁵. Moreover, shorter study durations (1-2 nights), lack of replication, methodological inconsistencies in assessment techniques (PSG vs actigraphy; daily sleep diary vs retrospective questionnaire) and settings (home vs. laboratory) have prevented data comparisons across studies¹⁵.

Kobayashi et al¹⁶ attempted to overcome these limitations by comparing self-reported sleep data from questionnaires and morning sleep diaries with objective data from in-lab PSG and home actigraphy. Further, they assess whether discrepancies between subjective and objective sleep indices are moderated by current or prior PTSD status. According to results, PTSD did not consistently contribute to discrepancies between subjective and objective sleep measures. Specifically, participants who did not meet current PTSD criteria overestimated total sleep time (TST) relative to actigraphy measures. With respect to sleep onset latency (SOL), all participants overestimated SOL in the sleep diaries relative to PSG, but not to actigraphy. In addition, while participants with current or lifetime PTSD overestimated SOL via self-report questionnaires relative to PSG, the other groups underestimated SOL. Finally, all participants underestimated time spent awake after sleep onset (WASO) relative to actigraphy.

Suggestions for use of actigraphy in PTSD studies

- Conduct PTSD study for at least 14 days with 7 days of pre-screen time
- Enroll PTSD subjects that meet the DSM-IV criteria
- Consider conducting additional enrollment screening with the clinician PTSD assessment scale
- Consider presence of known and unknown co-morbid conditions and medication usage in PTSD subjects

This coupled with subjective assessment scales will aid towards a more targeted evaluation of sleep disturbances associated with PTSD.

Recommended actigraphy endpoints

Recommended activity endpoints:

- mean activity during active and rest periods and standard deviation of mean,
- peak daily activity,
- Signal characteristics such as skewness, Shannon's entropy, and kurtosis.

Recommended sleep endpoints:

- total sleep time (hours/night),
- Sleep onset latency (minutes)
- wake after sleep onset (minutes)
- sleep efficiency (%)
- average wake bout duration (minutes)
- mean nighttime activity (counts/ minute)

Once the accelerometry data are collected, it can be re-analyzed easily and quickly as new algorithms are developed and published.

References:

- ¹ Kessler RC, Sonnega A, Bromet E, Hughes M, Nelson CB. Posttraumatic stress disorder in the National Comorbidity Survey. *Arch Gen Psychiatry.* 1995 Dec; 52(12):1048-60.
- ² Calhoun PS, Wiley M, Dennis MF, Means MK, Edinger JD, Beckham JC. Objective evidence of sleep disturbance in women with posttraumatic stress disorder. *J Trauma Stress.* 2007 Dec; 20(6):1009-18.
- ³ Dagan Y, Zinger Y, Lavie P. Actigraphic sleep monitoring in posttraumatic stress disorder (PTSD) patients. *J Psychosom Res.* 1997 Jun;42(6):577-81.
- ⁴ Ohayon MM, Shapiro CM. Sleep disturbances and psychiatric disorders associated with posttraumatic stress disorder in the general population. *Compr Psychiatry.* 2000 Nov-Dec;41(6):469-78.
- ⁵ Babson KA, Feldner MT. Temporal relations between sleep problems and both traumatic event exposure and PTSD: a critical review of the empirical literature *J Anxiety Disord.* 2010 Jan;24(1):1-15
- ⁶ Breslau N, Roth T, Burduvali E, Kapke A, Schultz L, Roehrs T. Sleep in lifetime posttraumatic stress disorder: a community-based polysomnographic study. *Arch Gen Psychiatry.* 2004 May;61(5):508-16.
- ⁷ Habukawa M, Uchimura N, Maeda M, Kotorii N, Maeda H. Sleep findings in young adult patients with posttraumatic stress disorder. *Biol Psychiatry.* 2007 Nov 15;62(10):1179-82.
- ⁸ Mellman TA, Kulick-Bell R, Ashlock LE, Nolan B. Sleep events among veterans with combat-related posttraumatic stress disorder. *Am J Psychiatry.* 1995 Jan;152(1):110-5
- ⁹ Straus LD, Drummond SP, Nappi CM, Jenkins MM, Norman SB. Sleep variability in military-related PTSD: a comparison to primary insomnia and healthy controls. *J Trauma Stress.* 2015 Feb;28(1):8-16
- ¹⁰ Germain A. Sleep disturbances as the hallmark of PTSD: where are we now? *Am J Psychiatry.* 2013 Apr;170(4):372-82
- ¹¹ Lavie P, Katz N, Pillar G, Zinger Y. Elevated awaking thresholds during sleep: characteristics of chronic war-related posttraumatic stress disorder patients. *Biol Psychiatry.* 1998 Nov 15;44(10):1060-5.
- ¹² Dow BM, Kelsoe JR Jr, Gillin JC. Sleep and dreams in Vietnam PTSD and depression. *Biol Psychiatry.* 1996 Jan 1;39(1):42-50.
- ¹³ Kobayashi I, Huntley E, Lavela J, Mellman TA. Subjectively and objectively measured sleep with and without post traumatic stress disorder and trauma exposure. *Sleep.* 2012 Jul 1; 35(7):957-65
- ¹⁴ Germain A, Nielsen TA. Sleep pathophysiology in posttraumatic stress disorder and idiopathic nightmare sufferers. *Biol Psychiatry.* 2003 Nov 15;54(10):1092-8.
- ¹⁵ Klein E, Koren D, Arnon I, Lavie P. Sleep complaints are not corroborated by objective sleep measures in post-traumatic stress disorder: a 1-year prospective study in survivors of motor vehicle crashes. *J Sleep Res.* 2003 Mar;12(1):35-41.
- ¹⁶ Kobayashi I, Boarts JM, Delahanty DL. Polysomnographically measured sleep abnormalities in PTSD: a meta-analytic review. *Psychophysiology.* 2007 Jul;44(4):660-9.

