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CLINICAL REVIEW

The evidence base of sleep restriction therapy for treating insomnia disorder

Christopher B. Miller [a,b,*], Colin A. Espie [c], Dana R. Epstein [d,e], Leah Friedman [f,g], Charles M. Morin [h], Wilfred R. Pigeon [i,j], Arthur J. Spielman [k,l], Simon D. Kyle [m]

[a] Centre for Integrated Research and Understanding of Sleep (CIRUS), Woolcock Institute of Medical Research, Sydney Medical School, University of Sydney, Australia
[b] Institute of Neuroscience & Psychology, University of Glasgow, UK
[c] Nuffield Department of Clinical Neurosciences and Sleep & Circadian Neuroscience Institute, University of Oxford, UK
[d] Phoenix Veterans Affairs Health Care System, USA
[e] Arizona State University College of Nursing and Health Innovation, USA
[f] Department of Psychiatry and Behavioral Sciences, Stanford University, Palo Alto, USA
[g] Veterans Affairs Palo Alto Health Care System, Palo Alto, CA, USA
[h] Université Laval, Québec City, Québec, Canada
[i] Sleep & Neurophysiology Research Lab, University of Rochester Medical Center, USA
[j] Center of Excellence for Suicide Prevention, U.S. Department of Veterans Affairs, USA
[k] Cognitive Neuroscience Doctoral Program, The City College of the City University of New York, USA
[l] Weill Cornell Medical College, Center for Sleep Medicine, NY, USA
[m] School of Psychological Sciences, University of Manchester, UK

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SUMMARY

Sleep restriction therapy is routinely used within cognitive behavioral therapy to treat chronic insomnia. However, the efficacy for sleep restriction therapy as a standalone intervention has yet to be comprehensively reviewed. This review evaluates the evidence for the use of sleep restriction therapy in the treatment of chronic insomnia. The literature was searched using web-based databases, finding 1344 studies. Twenty-one were accessed in full (1323 were deemed irrelevant to this review). Nine were considered relevant and evaluated in relation to study design using a standardized study checklist and levels of evidence. Four trials met adequate methodological strength to examine the efficacy of therapy for chronic insomnia. Weighted effect sizes for self-reported sleep diary measures of sleep onset latency, wake time after sleep onset, and sleep efficiency were moderate-to-large after therapy. Total sleep time indicated a small improvement. Standalone sleep restriction therapy is efficacious for the treatment of chronic insomnia for sleep diary continuity variables. Studies are insufficient to evaluate the full impact on objective sleep variables. Measures of daytime functioning in response to therapy are lacking. Variability in the sleep restriction therapy implementation methods precludes any strong conclusions regarding the true impact of therapy. A future research agenda is outlined.

Sleeping is no mean art: for its sake one must stay awake all day. – Friedrich Nietzsche

Sleep restriction therapy (SRT) is a behavioral intervention that is used to treat chronic insomnia [1,2], either as single component therapy, or as part of cognitive behavioral therapy for insomnia (CBT-I) [3,4]. Anecdotally, SRT is believed to be one of the most active elements of CBT-I. Indeed, Spielman et al. [5], emphasize the importance of SRT in an overview of 12 CBT-I trials, where all trials incorporated SRT procedures. However, the first American Academy of Sleep Medicine (AASM) practice parameters for the non-pharmacologic treatment of chronic insomnia considered SRT to be an optional patient-care strategy whereby, "patient improvement was unclear due to combination therapy" [6, p. 1131]. The most recent update of the AASM practice parameters suggest that SRT should be considered a "guideline" intervention due to the addition of two randomized controlled trials [2,7]. This is one step below

* Corresponding author. Woolcock Institute of Medical Research, Sydney Medical School, University of Sydney, PO Box M77, Missenden Road, Sydney, NSW 2050, Australia. Tel.: +61 (2) 9114 0451; fax: +61 (2) 9114 0014.
E-mail address: chris.miller@sydney.edu.au (C.B. Miller).

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Abbreviations

AASM	American Academy of Sleep Medicine
APA	American Psychological Association
CBT-I	cognitive behavioral therapy for insomnia
CS	case study
EEG	electroencephalography
ES	effect size
ESS	Epworth sleepiness scale
GSES	Glasgow sleep effort scale
ISI	insomnia severity index
ISQ	insomnia symptom questionnaire
MSLT	multiple sleep latency test
NOA	number of awakenings
NRCT	non-randomized control trial
PSG	polysomnography
PSQI	Pittsburgh sleep quality index
PVT	psychomotor vigilance task
RCT	randomized control trial
REM	rapid eye movement
SCT	stimulus control therapy
SE	sleep efficiency
SOL	sleep onset latency
SQ	sleep quality
SSS	Stanford sleepiness scale
SWS	slow wave sleep
TIB	time in bed
TST	total sleep time
UCT	uncontrolled clinical trial
WASO	wake time after sleep onset

that of a "standard" intervention such as stimulus control therapy (SCT) [7], as assessed through study design levels of evidence adapted from Sackett criteria [7,8]. Nevertheless, the review group and the AASM committee did conclude that "sleep restriction is effective and a recommended therapy in the treatment of chronic insomnia" [7, p. 1417].

Since the publication of the guidelines in 2006, behavioral interventions have shown further promise in controlled studies [4,9]. Recently, and salient to this review, Epstein et al. [10], conducted a dismantling study to compare multi component therapy (consisting of SRT and SCT with no structured cognitive therapy component), SRT, and SCT, to a waitlist control group. This study found SRT to be as effective as SCT and multi component therapy; suggesting SRT is a powerful standalone intervention. Earlier work also demonstrated that patient adherence to, and preference for SRT is more strongly associated with treatment outcome than other CBT-I components [11,12]. As a field, behavioral sleep medicine has encouraged broad dissemination of brief behavioral therapies [5,13–15], potentially as a "low-intensity" intervention within affordable stepped-care health-frameworks [16–19].

The aim of this review is to evaluate the evidence for the use of SRT in the treatment of chronic insomnia. It should be noted that we are referring in this review only to the therapeutic use of sleep restriction. We acknowledge that the term "sleep restriction" is more widely used in sleep science; usually in studies where healthy participants are experimentally exposed to a predefined (restricted) period of time in bed, to investigate the effects of sleep loss upon cognitive and physiological functioning [20,21]. Although not the focus of this review, closer reference to this experimental approach may be useful to aid understanding of both the acute effects and the therapeutic use of SRT for people with insomnia. Specifically, therapeutic SRT involves implementing a new prescribed sleep window (amount of total time allowed in bed) that initially matches the average total sleep time (from a one or two week sleep diary). Normally, for safety reasons, a minimum time in bed of no less than 4–5 h is used to protect against excessive daytime sleepiness. The sleep window is then titrated on a weekly basis through the use of average sleep efficiency scores from a weekly sleep dairy (see Table 1 for an example of the treatment guidelines) [5]. This is opposite to sleep compression therapy which uses a progressive and systematic reduction of time in bed to closely match sleep time/sleep need.

Our aim was to evaluate the evidence for the use of SRT in the treatment of insomnia. To achieve this aim, a systematic review of the literature was implemented. Suitable studies were then evaluated against a standardized quality assessment criteria [22] and levels of evidence (as per Sackett criteria [8]). Only studies that utilized SRT as a standalone intervention strategy for chronic insomnia, in accordance with SRT clinical guidelines [23] were included. Based on the evidence from the review, we conclude with a section regarding future directions to advance our understanding of SRT.

Method

Criteria for inclusion of research articles

This review aimed to include studies that were similar to the treatment delivery approach first described by Spielman et al. [1], This involves using the average total sleep time (from a one or two week sleep diary) to implement a new prescribed sleep window with the patient. More recently, a minimum time in bed of no less than 4–5 h is used to protect against excessive daytime sleepiness [3,5,24]. The sleep window is then titrated on a weekly basis through the use of average sleep efficiency scores from a weekly sleep dairy (see Table 1).

Online databases Web of Knowledge, PubMed, and Scopus were searched from 1986, one year before the publication of the SRT guidelines by Spielman et al. [1], until the end of October 2012. The search was re-run in August 2013 to take account of subsequent studies available online. The review used a subject and text word strategy with "insomnia" and "sleep restriction" or "sleep compression" (which is a systematic reduction of time spent in bed to closely match total sleep time/sleep need) as the primary search terms. Sleep compression therapy was included so that we would not miss any potentially relevant studies that may have applied a form of SRT. If the titles were appropriate and included any of the following terms: "insomnia", "behavior", "treatment" the online article was accessed and the abstract reviewed. Only full text articles were included and any published conference abstracts were omitted. If the abstracts were deemed suitable (for example, described a standalone intervention involving the curtailment of time in bed for the treatment of chronic insomnia), a full copy of the article was acquired and assessed for inclusion in this review (see Fig. 1). Studies were then considered for inclusion if they: a) implemented a standalone form of sleep restriction therapy; b) examined response to sleep-wake outcome

Table 1
Titration guidelines for sleep restriction therapy.

Sleep efficiency scores (SE)		
SE < 85%	SE ≥ 85% or <90%	SE ≥ 90%
Decrease TIB by 15 min	No change	Increase TIB by 15 min

Displays the recommended titration guidelines for sleep restriction therapy from Spielman et al. [5]. SE: sleep efficiency = (average total sleep time ÷ average time in bed from sleep diary) × 100; TIB: time in bed.