Sleep Gadgets

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Disclosures

I have no commercial relationships to any of the products or companies listed, and inclusion in this talk does not represent an endorsement.

Types of gadgets

- Wearables to track your sleep
- Devices to help you sleep
- Apps and internet based approaches

Wearables

- All based on measuring movements
- Usually worn on the non-dominant wrist

What do activity monitors do?

- Track rest-activity patterns, with software to quantitate movement and sleep
- Some with programs that estimate types of sleep (e.g.“deep” sleep, REM sleep)
- Advantages
  - Capable of monitoring multiple physiological parameters (e.g cardiac rhythm) to monitor clinical conditions
  - Technology continues to improve
  - Data can be fed into internet-based therapies for insomnia
  - At a population level, they increase awareness of sleep health

Caveats about using activity monitors

- Data are not necessarily accurate; sleep stage data not reliable
- May increase anxiety about sleep and thus worsen insomnia
- Increase focus on minutes of sleep rather than quality of sleep
- Many devices on the market, few have been properly validated

Blue light blocking glasses

- The circadian clock in the brain is most sensitive to blue light; exposure at night shifts sleep onset later in the night as well as increasing activation
- Wearing amber lenses for 1.5- 2 hours before bed improved sleep in individuals with insomnia (both subjective sleep and actigraphy data) in some studies

White Noise Machines

- Emit calming, monotonous sounds (e.g., wind, rushing water)
- Useful to drown out intermittent environmental noises (e.g., traffic, snoring, household noise)
- May also aid individuals with tinnitus

Cooling devices

Ebb Sleep
Cap

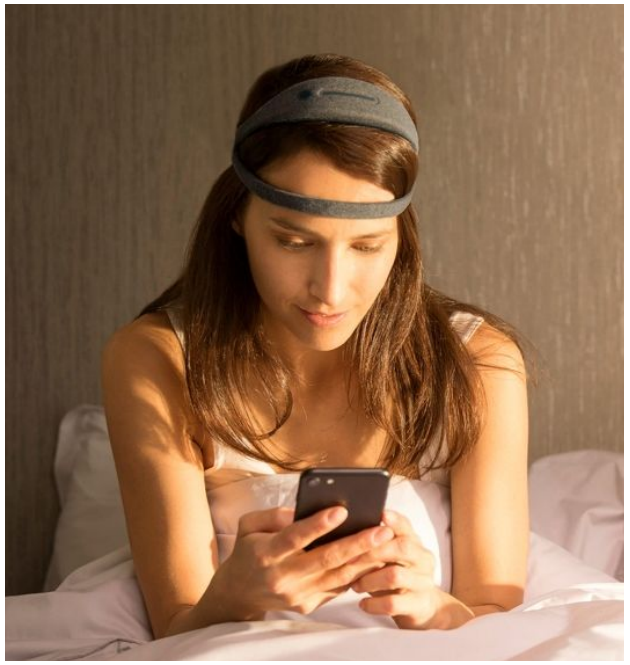
Chilipad cube

BedJet

Rationale

- Cooling the brain or dropping core body temperature reduces neural activity and promotes sleep
- Brain and body temperature cool during sleep, particularly during NREM slow wave sleep
- Head cooling devices cause drops in both brain and body temperature
- Evidence for improved sleep with brain cooling device
- Minimal data for other cooling devices

Stimulating slow wave sleep through tones



Dreem Headband
(Rhythm)

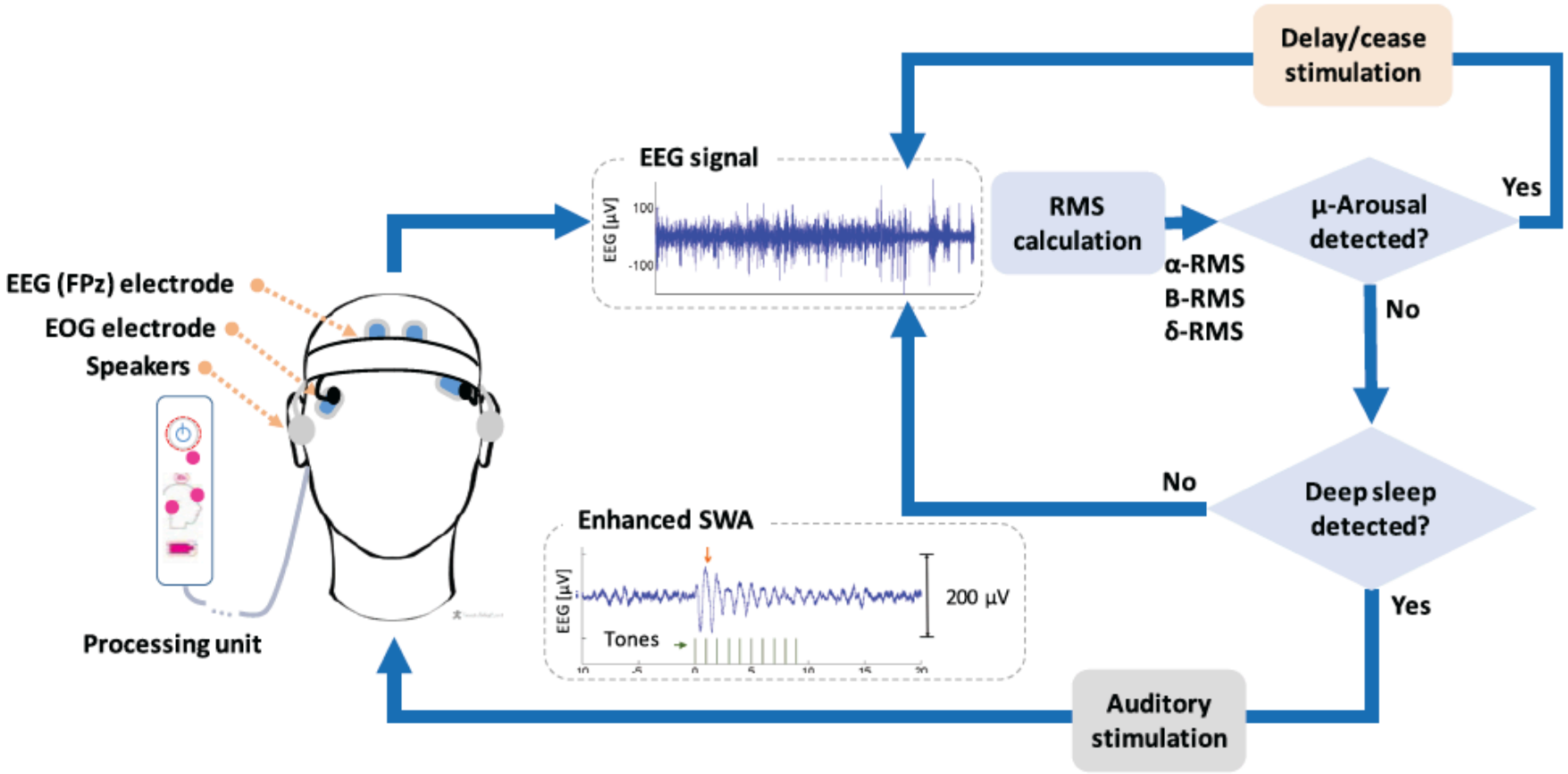
SmartSleep Deep Sleep Headband
(Philips)

Sleep Shepherd Blue
(Sleep Shepherd)

Rationale

- Slow waves are prevalent in deepest stages of non-rapid eye movement (NREM) sleep
- Slow wave functions include learning and memory (likely through normalization of synapses), clearance of toxic substances from brain (amyloid and tau proteins)

How it works


Delay/cease stimulation
EEG signal
EEG [µV]
100
-100
RMS calculation
α-RMS
B-RMS
δ-RMS
µ-Arousal detected?
Yes
No
EEG (FPz) electrode
EOG electrode
Speakers
Processing unit
No
Deep sleep detected?
Enhanced SWA
EEG [µV]
200 µV
Tones
Yes
Auditory stimulation

Evidence for effects

- Devices increase slow waves during sleep in normal subjects
- Effects greater in younger (<40 yrs) than older (≥40 yrs) adults
- No effect on total sleep or sleep stage amounts
- Effects on cognition, daytime function, physiology unclear; more research needed

Electromagnetic stimulation of slow waves using pulsed electromagnetic frequency (PEMF)

SR1 PEMF
Somniresonance

Oska Pulse

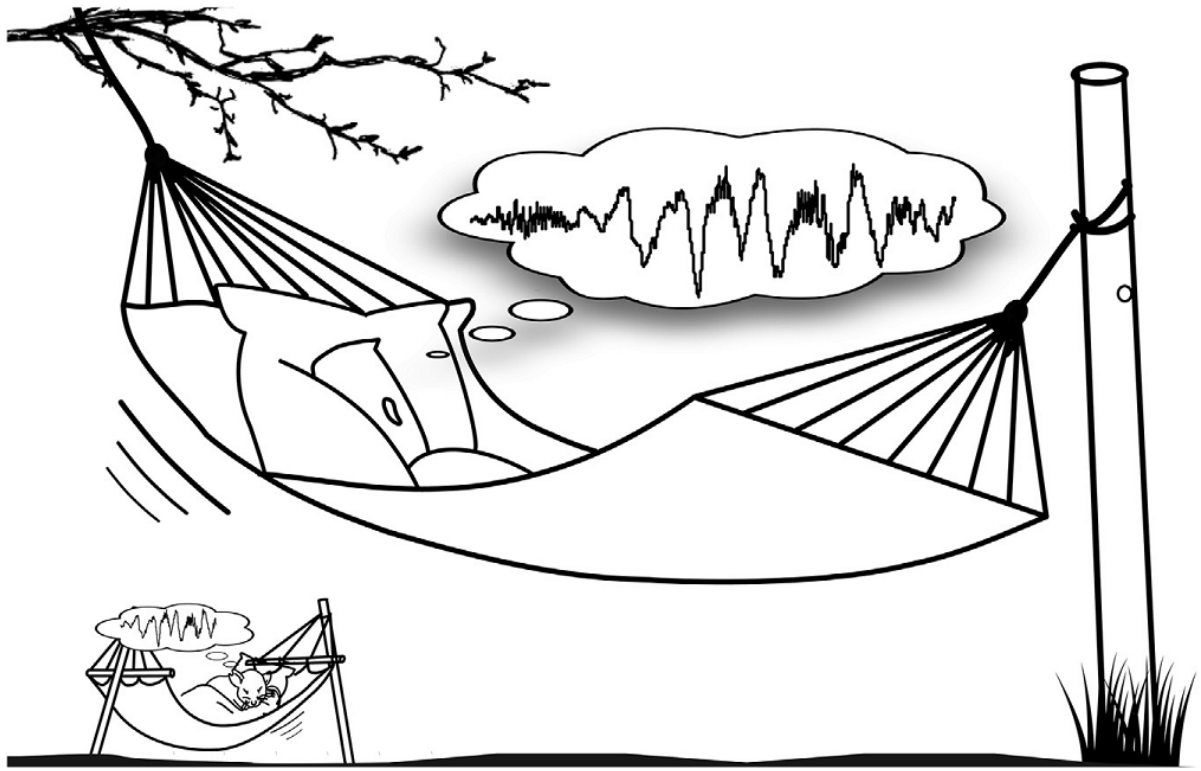
Cranial Electrotherapy Stimulation (CES)

Alpha-Stim

Rationale and results

- Delivers stimulation to the brain, PEMF like mild transcranial magnetic stimulation (TMS); CES like very mild electroconvulsive therapy “ECT light”
- Therapies developed for mood disorders and pain relief
- TMS and ECT increase waking brain activity which results in increased slow wave sleep--?? If this is the mechanism
- CES causes deactivation of brain after application
- Very minimal data on sleep effects; some studies suggest improved sleep on self report. One study that measured sleep in lab showed no effect of CES

Newer approaches under development



- Transcranial electrical stimulation; transcranial magnetic stimulation [TMS]
  - “Top down”; can be targeted to specific brain regions
  - May be able to target various brain EEG waveforms
- Other forms of sensory stimulation (e.g., auditory, olfactory, visual, somatosensory, visual, vestibular)
  - “Bottom-up”; less locally specific

Clocks

SmartSleep Wake Up Light Therapy Lamp – Philips
hOmelabs Sunrise alarm clock
Biobrite Sunrise clock

Rationale

- Light wavelength and intensity entrain circadian rhythms and have direct alerting effects
- Circadian system most sensitive to blue light
- Light-emitting clock simulate sundown and sunrise
  - Shift to red spectrum and decreasing intensity in the evening
  - Shift to blue spectrum and increasing intensity in the morning
- Useful for hearing impaired individuals

Cognitive Behavioral Therapy for Insomnia (CBT-I)

- Usually provided by trained therapist
- Computer-based forms available
  - Meta-analysis of 6 RCTs of computerized CBT-I[1]
  - Treatment had good acceptability (78% completed)
  - Estimated that 1 in 4 patients will recover from chronic insomnia with computerized CBT-I
- Examples:
  - Sleepio www.sleepio.com
  - VA CBT-i Coach (free) https://www.ptsd.va.gov/appvid/mobile/cbticoach_app_public.asp)

1. Cheng SK and Dizon J, Psychother Psychosom (2012) 81:206-216.

Questions?