STUDY: Nightly Use of Cove Technology Enhances Sleep Quality

Background

Before you can fall asleep, you first need to get comfy. If you're hungry, achy, too hot, or too cold, you aren't likely to slip into slumber. In fact, the brain has a special pathway that monitors these bodily sensations; and this process, known as interoception, plays an important role in sleep.

Interoception includes your sense of temperature and pain, as well internal sensations like heart rate and hunger. Optimal interoception has been linked to feelings of relaxation and wellbeing. When interoception is out of whack, however, even slight physical changes can be jarring. A minor bump in temperature, for instance, can lead to major discomfort, making it difficult to fall asleep. Worse, this physical discomfort can lead to emotional distress, keeping your brain alert and anxious into the night.

Encouragingly, research indicates that a specific form of light physical contact, called affective touch, can enhance interoception. In doing so, affective touch can also elicit feelings of calm and relaxation in the brain—precisely what is needed for a good night's rest. Building on this research, our scientists set out to create a device that would promote better sleep by tapping into the brain's affective touch response.

Hypothesis:

We hypothesized that a vibrating device, programmed to generate specific signals, could trigger the brain's affective touch response and improve sleep quality.

Methods:

To test our hypothesis, we designed a device that delivered specific slow, light vibrations just behind the ears—an early version of Cove's patented technology. We then invited 25 sleep-disturbed volunteers to incorporate this device into their nighttime routine. For one month, study participants used the device for 20 minutes per night, always within an hour of their usual bedtime.

To assess whether and how the device affected sleep, we asked volunteers to use a fitness tracker capturing sleep data for the duration of the study. Typically, these devices use photoplethysmography, or PPG, a relatively simple means by which to measure changes in blood flow. Though PPG may be able to determine whether a person is asleep, it cannot distinguish between different sleep stages—a capability reserved for a more sophisticated type of sleep study, known as polysomnography. As such, we used trackers only to measure total sleep hours. Of the devices tested, the Garmin Vívosmart 4 most reliably captured this metric.

Participants also filled out a sleep questionnaire at the beginning and end of the month-long trial. Known as the Pittsburgh Sleep Quality Index, or PSQI, this survey consists of 19 questions that evaluate different aspects of sleep, including: the time it takes to fall asleep; nighttime sleep disturbances; and daytime drowsiness. Answers to these questions can be summed to generate a "Global PSQI Score," which reflects overall sleep quality. Additionally, researchers can look at responses to specific questions to quantify changes in certain aspects of sleep. In both instances, higher scores indicate worse sleep quality.

Results

After using the device for one month, 86% of volunteers experienced considerable improvements in sleep, as measured by the PQSI. The group's Global PSQI scores improved by 43%—dropping from an average of 9.8 to 5.2 (Figure 1). Further, analysis of specific responses revealed positive changes in key areas: at the end of the trial, 77% of volunteers reported falling asleep faster and 68% reported a reduction in daytime drowsiness (Figure 2).

Figure 1. Global PSQI Scores Before and After 30 Days Using the Device

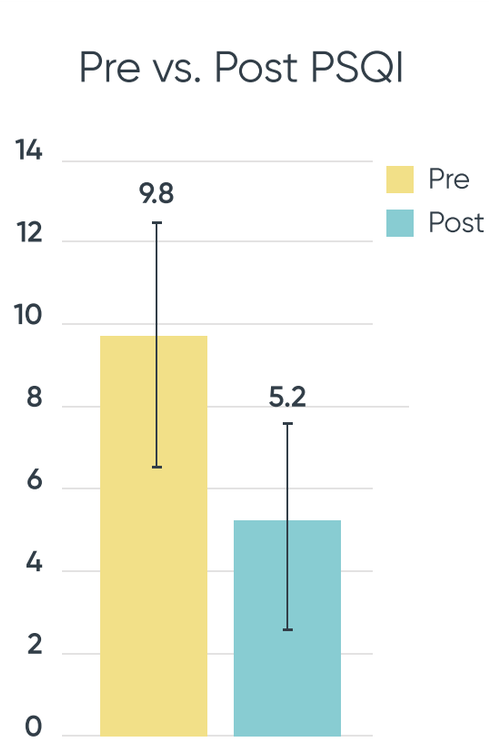
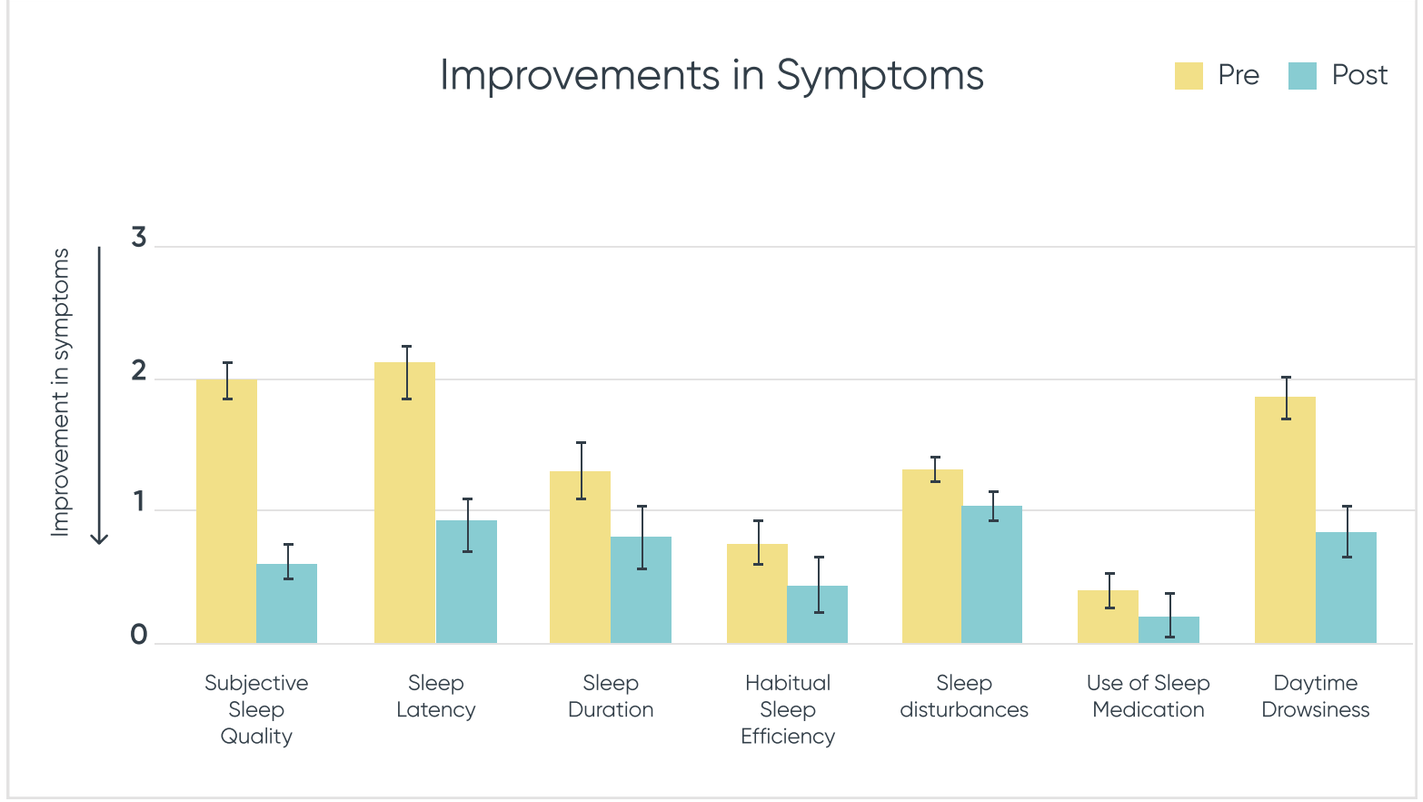
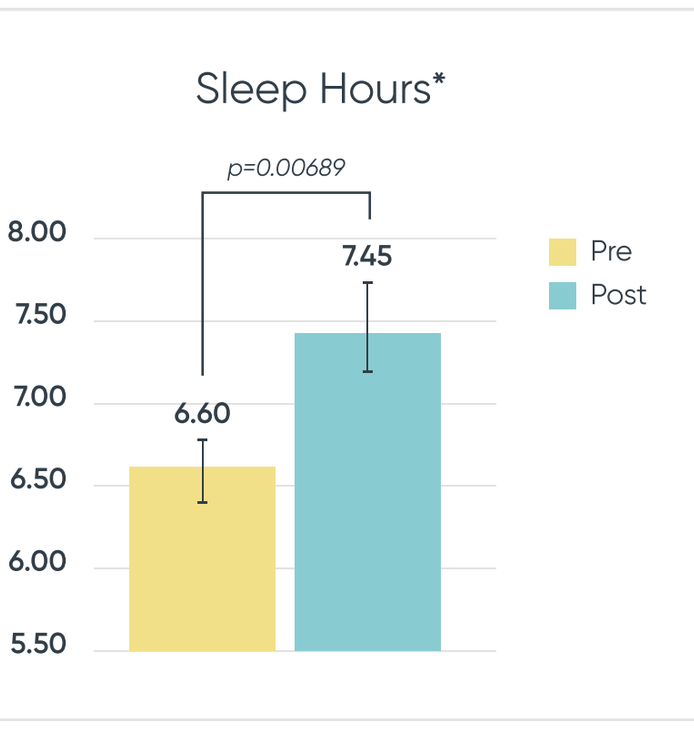


Figure 2. PSQI Scores for Specific Aspects of Sleep Before and After 30 Days Using the Device



These improvements were confirmed by data from the fitness trackers, which revealed that volunteers' nightly sleep time increased by an average 65 minutes (Figure 3).

Figure 3. Average Sleep Time Before and After 30 Days Using the Device



Conclusion:

This is the first human study to show that a device can improve sleep by activating the brain's affective touch response. These results are consistent with our neuroimaging studies, which show that these same vibrations promote activity in the insula, a critical component of the brain's interoceptive pathway. Indeed, it is likely that the vibrations improve sleep levels by enhancing interoception, which is often disturbed in people with sleep disorders. As such, we propose that this technology represents a promising new means by which to improve sleep quantity and quality. Though the study was relatively small and used a prototype, we are encouraged by our findings, and a larger, more robust clinical trial is currently underway.