Sleep Quality Predicts Resting Alpha Power in Abstinent Cocaine Users

Danielle A. Kessler[1], Scott D. Lane[2], Joy M. Schmitz[2], Robert Suchting[2], and Heather E. Webber[2]

[1]Drexel University College of Medicine; [2]University of Texas Health Science Center at Houston

Introduction

Cocaine & Sleep

- Chronic cocaine use contributes to decreased sleep quality through reduced sleep time [1]
- Sleep loss augments reward behavior and increases cocaine craving [1]
- Several weeks of abstinence improves sleep quality [2]

Electroencephalogram (EEG) Markers of Sleep Effects

- Alpha power occurs over the back of head during resting wakefulness
- Increased alpha power (8-13 Hz) - associated with neural deactivation and correlated with increased sleepiness [3,4]
- Differences in resting alpha power may depend on EEG recording condition (eyes open or eyes closed)
- Alpha power - positively correlated with sleepiness in the eyes open condition, negatively correlated with sleepiness in the eyes closed condition[5]

Current Study

- Alpha power & sleep has been studied in healthy samples, but this effect has not been investigated in substance users, a population known to have poor sleep quality
- Goal of the current study: assess effects of at least 4 weeks cocaine abstinence on the relationship between sleep quality and alpha power

Methods

Participants

- 17 current cocaine use disorder
- 15 current cocaine use disorder with 1-6 months abstinence

Subjective Sleep Quality

- Quality of sleep over the past seven days (rating 1-10)
- Quality of sleep from the previous night (rating 1-10)

Resting state EEG

- 90 seconds of resting state EEG recorded in two conditions: eyes open and eyes closed
- EEG data collected with 64-channel actiCAP, amplified with Brain Amp MR, recorded with Brain Vision Recorder
- EEG data preprocessed in Brain Vision Analyzer
- Alpha power was calculated using the Fast-Fourier transformation and averaging the log-transformed power spectra of the alpha band (8-13 Hz)

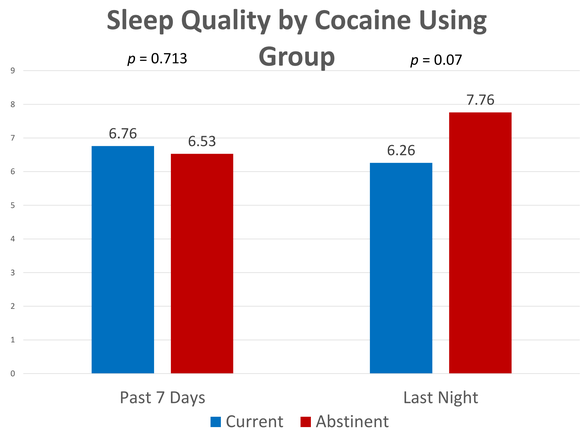
Statistical Analyses

- Pearson correlations used to measure the relationship between self-reported sleep quality from the past seven days/last night and alpha power at 64 electrodes
- Correlations performed separately for the eyes opened and eyes closed conditions

Results

Sleep Quality by Group

- No differences in sleep quality between current and abstinent cocaine users for the past 7 days or the last night

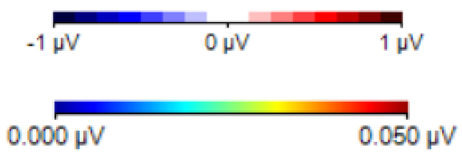


Alpha Power & Sleep Quality

- Abstinent cocaine users: alpha power was negatively correlated with self-reported sleep quality over the past 7 days in both the eyes opened and eyes closed conditions (largest r = -0.68, $p < 0.05$)
- Significant correlations observed in the occipital region (eyes closed condition) and the right temporal region (eyes opened condition)
- Current cocaine users: alpha power was not significantly associated with sleep quality at any electrode (largest r = -0.32, $p > 0.05$)
- R values from the Pearson correlations and associated p values are mapped onto the corresponding electrodes in the figures to the right

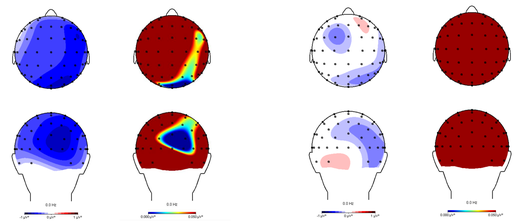
Figure Scaling

- Top scale: Represents Pearson's R values for the correlations
- Bottom scale: Represents p values for the correlations

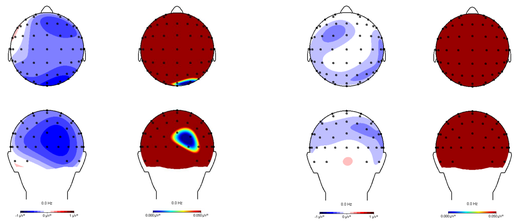


Results

Eyes Closed Condition

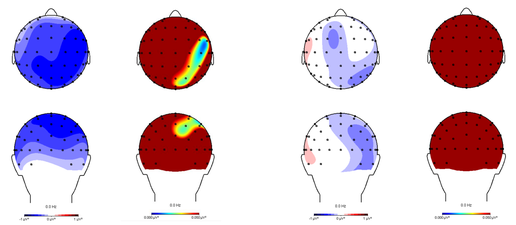


Above: Correlation between alpha power and sleep over the past seven days in abstinent users (left) and current users (right).

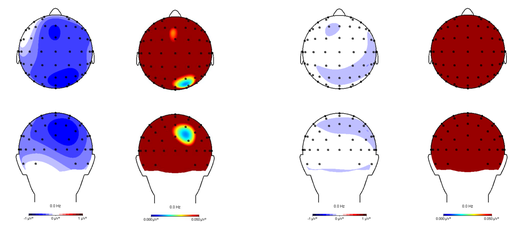


Above: Correlation between alpha power and sleep over the last night in abstinent users (left) and current users (right).

Eyes Open Condition



Above: Correlation between alpha power and sleep over the past seven days in abstinent users (left) and current users (right).



Above: Correlation between alpha power and sleep over the last night in abstinent users (left) and current users (right).

Discussion

- Lower sleep quality associated with larger measures of resting neural deactivation in abstinent cocaine users
- Relationship is strongest for sleep quality ratings over the past seven days than over the last night
  - Accumulation of poor sleep has a greater impact on neural activation than one night of poor sleep
- Stronger correlations were observed for eyes closed compared to eyes opened
  - Consistent with less neural activation due to visual input in the occipital region when eyes are closed
- Relationship between lower sleep quality and neural deactivation is not seen in current cocaine users
- In current cocaine users, sleep quality might not significantly impact alpha power
  - With at least 4 weeks of abstinence, better sleep quality was associated with less resting alpha power (i.e., less neural deactivation)
  - Current users may not get as much benefit from sleep as abstinent users, even if subjective sleep is similar
  - Could signify brain returning to homeostasis with abstinence
- Results highlight resting alpha power as a potential target for addressing sleep issues or as an objective measure of sleep effects in individuals with substance use disorders

Future Prospects

- Relationship between sleep quality and alpha power should be further studied in substance using populations
- Future directions include identifying treatments that target sleep and/or alpha power changes in current cocaine users

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