

The Effect of Slow-Wave Disruption on Motivation and Effort in Major Depressive Disorder



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Background

Major Depressive Disorder (MDD) is a pervasive mood disorder that affects nearly 350 million people worldwide¹.

Motivation and effort are related processes that are both impaired in MDD². Motivation is a thought or feeling that gives purpose to a behavior, and effort is the physical or mental exertion of that behavior³.

Sleep disturbances are also common in MDD, including sleep slow-wave activity (SWA)⁴. Interestingly, studies show that depressive symptoms improve after slow-wave disruption (SWD).

Therefore, we hypothesized that after a night of SWD, motivation and effort would improve in participants with MDD.

Method

Fourteen participants from the greater Philadelphia area were sorted into two groups: healthy controls with no history of MDD (HC, $n=7$), and currently diagnosed MDD ($n=7$).

Subjects completed a 3-hour screening visit to determine eligibility. Then, they participated in two nights of sleep in the laboratory, one week apart: one baseline (BL) and one SWD, where their SWA was disrupted using auditory tones but total time spent asleep remained intact. Nights were randomized and counterbalanced.

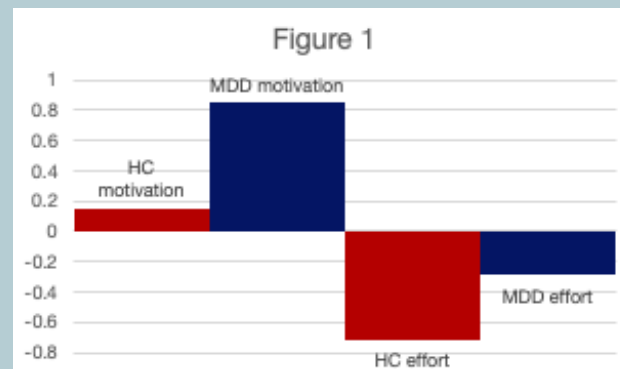
MAP-SR The Motivation and Pleasure Scale Self-Report – Adapted (MAP-SR) is a six-item questionnaire that assesses motivation and effort in three scenarios⁵. Higher scores equate to greater motivation and willingness to exert effort.

EEFRT The Effort Expenditure for Rewards Task (EEFRT) is a computerized task designed to measure anhedonia (lack of motivation and reward responsivity) in MDD⁶. Participants could choose to complete an easy task or a hard task; the proportion of hard task choices represented greater effort exertion and motivation to achieve a higher monetary reward and were thus used for this analysis.

Both measures were completed following each night of sleep and results were analyzed at both timepoints.

Results

MAP-SR Items 1, 3, and 5 of the MAP-SR were combined to make a 'motivation subscale'; items 2, 4, and 6 were combined to make an 'effort subscale'. Figure 1 shows change scores on both subscales between BL and SWD for HC and MDD. Trends towards increased motivation ($p=0.19$) and decreased effort ($p=0.34$) are seen in the MDD group, and towards decreased effort ($p=0.17$) in the HC group after SWD. *No results were statistically significant.*



EEFRT The HC group showed a trend towards increased hard task choice after SWD ($p=0.15$) and MDD group showed a potential trend towards decreased hard task choice after SWD ($p=0.43$). Figure 2 shows the proportion of hard task choices for HC and MDD after BL and SWD. *No results were statistically significant, and due to technical issues with the task, HC group $n=2$ and MDD group $n=3$ for this analysis.*



Conclusion

MAP-SR While not statistically significant, there is a trend towards improved motivation and diminished willingness to exert effort in MDD after SWD. Increased motivation is consistent with our hypothesis, however, decreased effort is not. These same patterns are shown in the HC group as well.

EEFRT The trends shown in this task opposed our hypothesis of greater motivation and effort exertion after SWD in MDD, and this pattern was found in the control group instead. Although, again, no findings here were statistically significant. However, even if findings were significant, this data would not be considered valid due to extremely small sample size from technical difficulties with the task.

Limitations & remarks The greatest limitation was sample size for both the MAP-SR ($n=14$) and EEFRT ($n=5$), due to the fact that this is an ongoing study in its early phases of data collection (total $n=60$ in 2022). Therefore, this data should continue to be monitored as the study proceeds in order to determine if SWD has a positive impact on motivation and effort in MDD as compared to the HC population. If our hypothesis is rendered correct, this could point to SWD as an emerging treatment for MDD.

References

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