

Depressed Mood, Index Finger Force and Motor Cortex Stimulation: A Transcranial Magnetic Stimulation (TMS) Study

Desmond J. Oathes and William J. Ray

The Pennsylvania State University, Department of Psychology, University Park, PA

Background and Introduction

- With increasing task difficulty/complexity, performance discrepancies between clinically depressed and control participants widen (Hartlage, et al., 1993)
- Neurovegetative symptoms are included as part of DSM-IV diagnoses of mood disorders and in symptom scales including the Beck Depression Inventory (BDI)
- “Psychomotor” symptoms associated with Depression most often are studied in ways that make it impossible to differentiate cognitive from basic motor processes
- Transcranial magnetic stimulation (TMS) has been used to study the cortico-spinal-motor track independent of cognitive task requirements (see Insert)
- Inconsistent findings with “depressed” clinical populations are difficult to decipher given heterogeneity of patients groups that likely differ according to motor functioning (e.g. mixing actively manic patients with those suffering from uni-polar depression)

Purpose of Study

- evaluate basic motor processes according to depressive symptoms independent of cognitive task requirements and diagnostic category

Methods

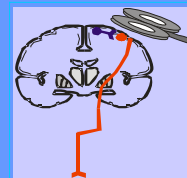
- Beck Depression Inventory (BDI) and Depression Proneness Rating Scale (DPRS) separated “depressive” from “non-depressive” university students enrolled in Introductory Psychology
- 6 depressive (3 female) and 6 non-depressive (5 female) participants

References

Hartlage, S., Alloy, L.B., Vazquez, C., & Dykman, B. (1993). Automatic and effortful processing in depression. *Psychological Bulletin*, 113, 247-278.

* is $p < .05$; ** is $p < .005$; *** is $p < .001$

Transcranial Magnetic Stimulation (TMS) is a non-invasive technique for stimulating cortical cells, and in the present context the motor cortex. Stimulation in the cortex occurs as a result of electricity pulsed through a wire coil held over the subject's scalp. The electric current produces a magnetic field parallel to the surface of the scalp and results in the generation of a secondary current that causes depolarization of neural cells.



	Depressive	Non-Depressive
BDI	17.5 (3.08)	2.25 (3.22)***
Mean (StDev)	mild to moderate depression	little or no depression
DPRS	61.33 (10.73)	30.83 (6.47)**
Mean (StDev)		

Recording Procedure

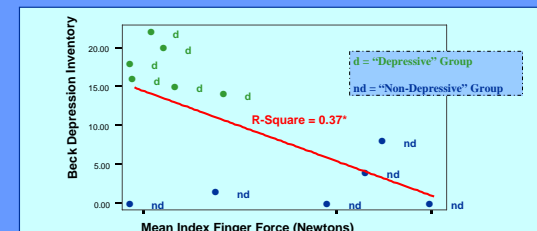
- forearm electromyography (EMG) and index finger force measures were collected during resting state for all participants.



- stimulations were delivered at 140% of motor threshold for each participant
- Right (dominant) forearm flexor and extensor EMG recorded at 1,000 Hz
- Stimulations at 3-7 second random interstimulus intervals at 140% motor threshold (MT)
- MT defined as minimum stimulation intensity to evoke forearm flexor EMG of 50 microvolts in 5/10 trials (standard for TMS)

Results

1. “Depressive” group had significantly higher scores on BDI, Depression Proneness, & all scales of Multiscale Depression Inventory relative to “Non-depressive” controls.
2. At Baseline, group endorsing more negative emotion exhibited less right index finger force (in Newtons) evoked by TMS relative to less negative group.
3. A negative correlation was found between severity of depressive mood symptoms (by BDI) and mean right index finger force evoked by TMS.
4. Though gender distribution varied by depressive/non-depressive group, gender did not discriminate BL index force or BDI.
5. Also, a measure of maximum voluntary contraction in Force amplitude recorded from right index finger did not discriminate the groups.



Conclusions

- Motor differences are present even in non-clinical groups according to degree of depressive symptoms.
- A negative relationship exists between output from the cortico-spinal motor track and degree of depressive symptoms by self-report.
- Though motor differences in mood separated groups might be compounded by cognitive differences, basic motoric processes deserve evaluation in their own right.
- Further research evaluating diagnostic category, in/out-patient status, and impact of group differences on cognitive and neuropsychological tests are warranted.