

Exploring the efficacy of non-invasive brain stimulation in older adults: the role of cardiovascular risk factors and baseline depression scores.

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Background

- Brain stimulation can elevate mood in healthy young adults and adults with depression when applied to the dorsolateral prefrontal cortex (DLPFC).
- Changes in brain microstructure associated with aging and cardiovascular risk factors (CVRF) may reduce the efficacy of brain stimulation.
- Transcranial random noise stimulation (tRNS) was used to increase the excitability of the DLPFC.
- Change in mood was assessed among older adults with and without CVRF.

Hypotheses

- tRNS over the DLPFC will elevate mood.
- The efficacy of tRNS may differ depending on age and presence of CVRF.

Method

- Participants:** YA - Young adults (aged 20-40); HOA - older adults (>60) without CVRF; OVR - older adults with CVRF.
- OVR group assignment based on presence of high blood pressure or cholesterol, or a diagnosis of diabetes.
- Framingham stroke risk profile (FSRP) score quantified risk.
- Test batteries/self report measures:** Wechsler Test of Adult Reading (WTAR); Geriatric Depression Scale (GDS); Positive and Negative Affective Scale (PANAS).

Table 1: Demographics, mean (standard deviation)

	YA (n=29)	HOA (n=34)	OVR (n=26)
Age	26.55 (5.30)	67.68 (6.80)	66.88 (6.72)
Sex (m,f)	15,14	13, 21	12,14
FSRP(%) ^a	1.85 (1.30)	1.94 (1.02)	4.48 (2.32)
GDS	5.28 (3.49) ^c	3.38 (4.07)	4.50 (4.55)
WTAR FSIQ	109.79 (6.49)	111.91 (5.36)	109.04 (7.32)

^awith age removed as a factor, OVR scored significantly worse on the FSRP(%) than YA and HOA whose scores were comparable.

^cnonparametric Mann-Whitney U analyses confirmed YA had higher scores of depression compared to HOA ($r=.243$, $p=.005$, $d=.501$); GDS scores comparable between HOA - OVR and YA - OVR.

- Procedure:** Over 2 sessions participants received Real or Sham tRNS (stimulation applied for 15 secs & switched off).
- Current mood was recorded before and immediately after tRNS using PANAS-Positive Affect (PA).
- Mood Change = PANAS PA_{Post tRNS} - PANAS PA_{Pre tRNS}
- General mood was recorded using the GDS.

Brain Stimulation

- Participants received 10 mins of real tRNS or sham tRNS over 2 sessions.
 - 1st 5 mins: sat quietly.
 - 2nd 5 mins: talked about positive memory.
- 1mA of tRNS applied bilaterally over the DLPFC using 5x5cm electrodes.

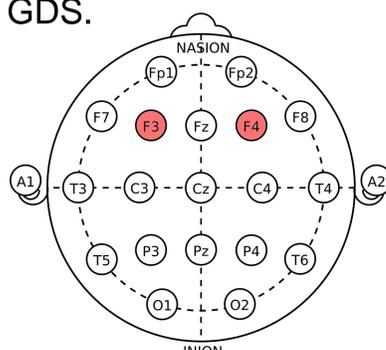


Figure 1: Electrode placement over DLPFC

Results

- Group comparisons (Mann-Whitney U):** Differences between stimulation conditions for change in PA scores do not reach significance.
- Figure 2 suggests a greater mood increase after Real tRNS.
- Effect of Real tRNS similar between YA and HOA; OVR smaller effect of tRNS

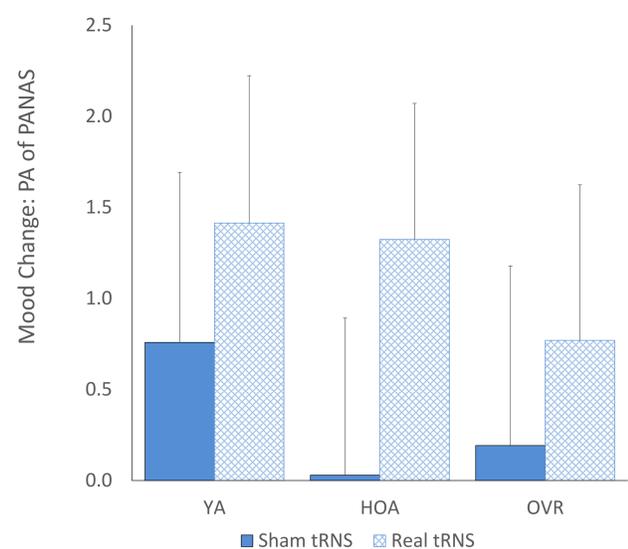


Figure 2: Group differences for Mood Change for Positive Affect scores of the PANAS

- GDS & Mood Change Correlations (Spearman's rho):** in YA, higher depression scores correlated with less change in mood after Real tRNS. NB: similar trend after Sham tRNS in YA.

Table 2: GDS & Mood Change Correlations by Group

Mood Change	YA (n=29)	Old (n=60)	HOA (n=34)	OVR (n=26)
GDS*Sham tRNS	$r_s=-.347$, $p=.065$	$r_s=-.138$, $p=.294$	$r_s=-.130$, $p=.462$	$r_s=-.186$, $p=.362$
GDS*Real tRNS	$r_s=-.608$, $p<.001^*$	$r_s=-.188$, $p=.150$	$r_s=.106$, $p=.550$	$r_s=.283$, $p=.161$

* $p<.05$

Conclusion

- GDS scores are higher in younger than older adults.
- Change in mood in response to tRNS does not appear to differ with age.
- In the mild CVRF group (OVR), there is less response to Real tRNS than in HOA; CVRF may reduce effects of tRNS on mood.
- Endorsement of depressive symptoms seems to influence response to tRNS.
- Future studies should examine the impact of more severe CVRF on mood in aging.

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Glossary:

GDS – Geriatric Depression Scale
PANAS – Positive and Negative Affect Schedule
MMSE – Mini Mental State Exam
WTAR FSIQ – Wechsler Test of Adult Reading predicted FSIQ

