Effect of Anodal TDCS on StartReact in Healthy Young and Old Adults

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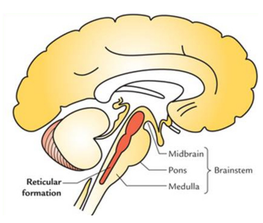
INTRODUCTION



- **The Reticulospinal Tract** (RST) may contribute to age-related changes to **motor control** [1].
- RST activity can be modulated using **Transcranial Direct Current Stimulation (TDCS)** [2].
- RST activation is assessed using the **StartReact paradigm** [3], where a startling acoustic stimulus involuntarily triggers a pre-planned movement [4], resulting in shortened reaction times and increased rate of force development (RFD) [5].

METHODS

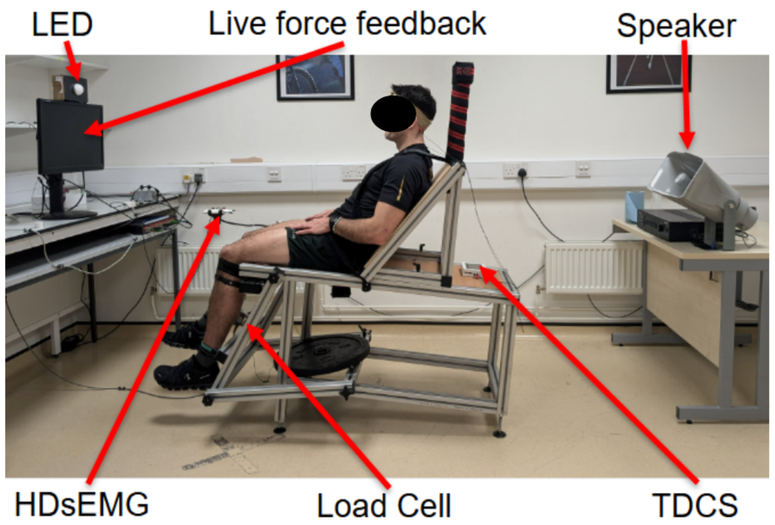
- 44 healthy recreationally active adults divided into two age groups; **18-40** (Young; n=24; 12F) and **65-80 years** (Old; n=20; 10F).
- Two experimental sessions, each consisting of **two StartReact Tasks** (*Pre* and *Post*) with ~30 minutes rest.
- During 2nd StartReact Task, **anodal- or sham- TDCS** applied.

Randomly ordered "go" cues:

Visual (VC; LED)

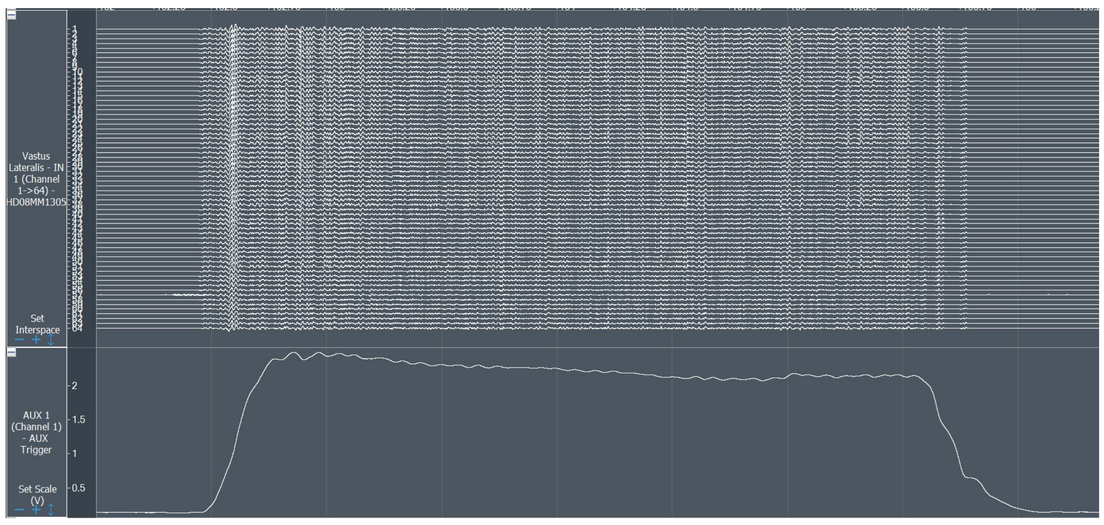
Visual-auditory (VAC; LED +80dB)

Visual-startling (VSC; LED +110dB)



StartReact Task

- 18 isometric knee extensions, "as fast and as hard as possible".
- 75% Maximum Voluntary Force (MVF) target in response to "go" cue.
- Force & High Density sEMG (Vastus Lateralis) signals recorded.



Data Processing and Analysis:

- Force onset time determined manually via visual inspection and inversely transformed for analysis.
- For each StartReact Task, three trials that had the highest force at 150ms after onset were selected for full analysis, for each cue type.
- Force signal was analysed in the first 250ms following force onset, and normalised to MVF for comparisons between groups.
- RFD: From force onset, the first derivative of force was calculated over all overlapping 1–250 ms intervals to identify the maximal RFD.

RESULTS

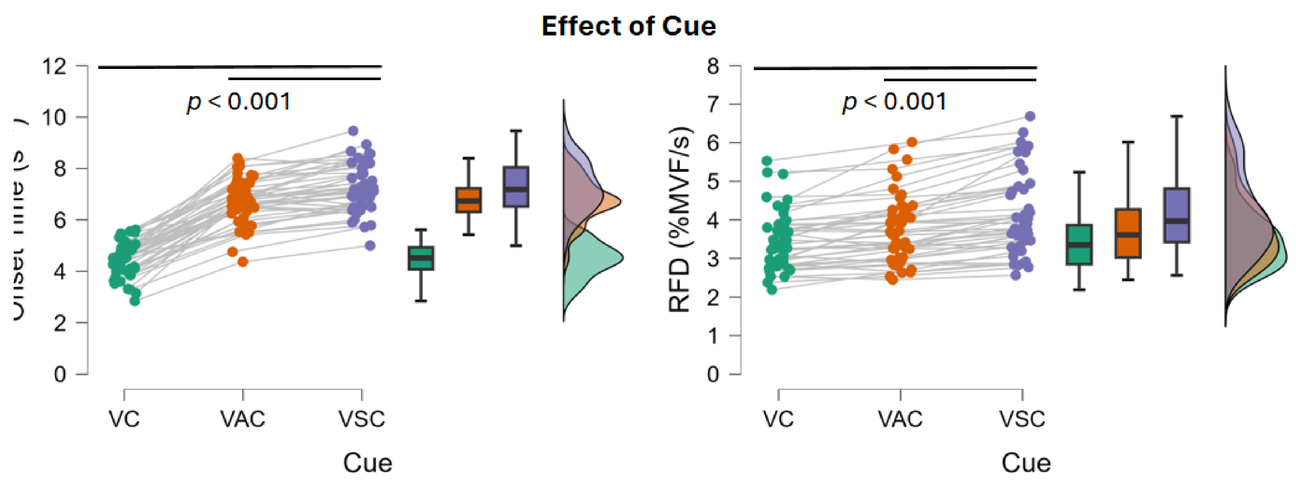


Figure 1. Pooled data from all StartReact Tasks and both Age Groups.
Significant interaction effect of Cue for each StartReact Task in both Age Groups, all, p < .001, ηp2 > 0.14. Post hoc: all VSC higher than VAC; *p* < .001 (Bonferroni).

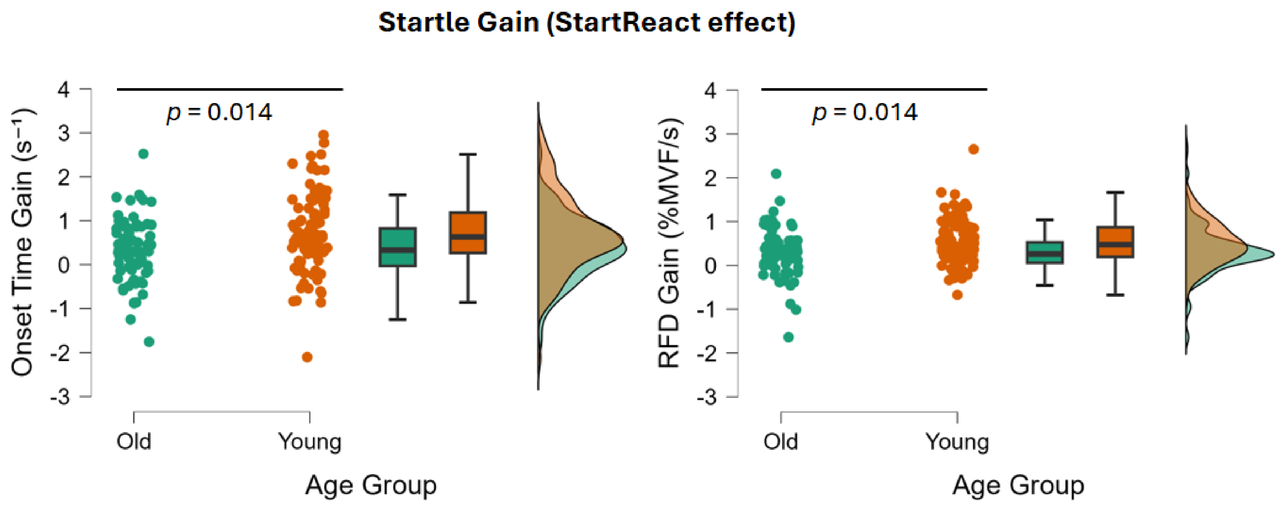


Figure 2. Startle Gain (StartReact effect: difference between VAC and VSC).
Significant interaction effect of Age Group.
Peak force not different between Age Groups.

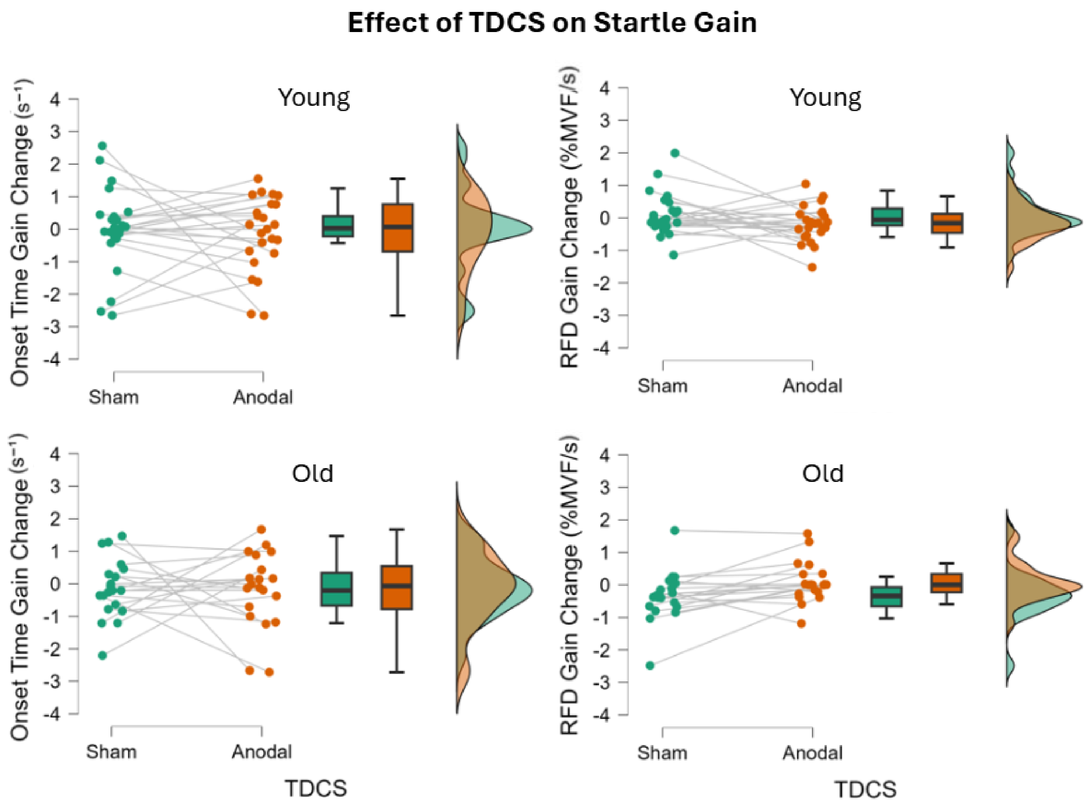


Figure 3. TDCS Change (difference between *Pre* and *Post* Startle Gain).
RFD: Significant interaction effect of TDCS * Age Group, *p* = 0.005, ηp2 = 0.173.
Post hoc: no significant differences (Bonferroni).

CONCLUSION

1. **A VSC shortened Force Onset Time and increased RFD**, indicating consistent RST activation in both Age Groups.
2. **Startle Gain (StartReact effect) was reduced in old adults**, with smaller reaction time and RFD benefits compared to young adults, despite similar peak force capabilities.
3. **TDCS modulated RFD but not Force Onset Time,** highlighting the potential of TDCS to influence RST function via peripheral rather than central mechanisms.

Future work: Decomposition and analysis of High Density sEMG recordings to investigate effects on Motor Unit characteristics (e.g. discharge rate and recruitment threshold).

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