

# The effects of transcranial direct current stimulation (tDCS) on corticobulbar excitability and swallowing



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inspiring achievement

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## Background

Dysphagia rehabilitation has traditionally focused on manipulating swallowing biomechanics via rehabilitative and compensatory interventions. Recent years have seen an increase in the exploration of neurostimulation techniques as potential approaches for improving swallowing function<sup>1,2</sup>. One of these neurostimulation techniques is transcranial direct current stimulation (tDCS)<sup>3,4</sup>. Anodal tDCS can enhance swallowing motor cortex excitability when applied over the floor-of-mouth (FOM) representation in the primary motor cortex<sup>5</sup>. The functional correlates of the neurophysiological changes seen following anodal tDCS remain to be investigated.

## Objective

To investigate the effects of anodal tDCS on the excitability of the corticobulbar motor representation of the FOM musculature and swallowing function.

## Methods

17 young, healthy participants (15 females, 23.6 years, 21-29 years) received 20 minutes of sham and anodal tDCS at 1.5mA in random order, in separate sessions.

Outcome measures, assessed at baseline and up to 45 minutes following stimulation, included:

- Swallowing capacity and volume as per the Timed Water Swallow Test<sup>6</sup>
- Maximal tongue pressure as assessed by the Iowa Oral Pressure Instrument (IOPI)<sup>7</sup>
- Tongue pressure generated during saliva swallowing using the IOPI<sup>7</sup>
- Accuracy on skill-based swallowing task
- Motor evoked potential (MEP) amplitude in the floor of mouth (FOM) musculature

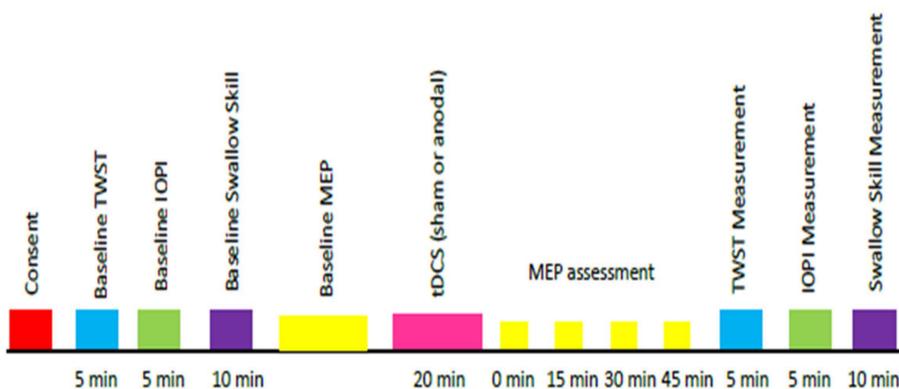


Figure 1: Timeline of each research session

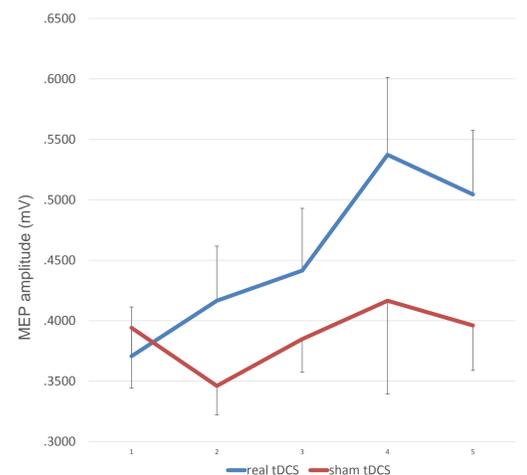
## References

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## Results

### Motor evoked potentials

MEP amplitude significantly increased at 30min ( $p=0.015$ , CI: 0.312, 0.041) and 45min ( $p=0.006$ , CI: 0.24, 0.49) following anodal tDCS. No changes were observed following sham tDCS (all  $p>0.05$ ).



### Swallowing function

There were no changes in any of the functional outcome measures of swallowing capacity and volume, maximal and swallowing tongue pressure or accuracy on a skill-based swallowing task (all  $p>0.05$ ).

Outcome Measure	Mean		Sig. (p value)	CI	
	Baseline	Post		Lower	Higher
Swallow Volume (ml)	24.3 (7.35)	23.8 (7.17)	0.572	-1.24	2.15
Swallow Capacity (ml/s)	22.1 (6.51)	21.5 (8.66)	0.617	-2.03	3.30
Time per Swallow (s)	1.12 (0.28)	1.15 (0.03)	0.480	-0.14	0.07
Swallowing Skill (PQ)	156.1 (88.2)	224.1 (213.4)	0.222	-182.9	46.5
Maximum Tongue Pressure (mmHg)	48.8 (11.3)	47.6 (11.7)	0.500	-2.41	4.7
Relative Tongue Pressure (mmHg)	40.04 (16.8)	39.7 (18.3)	0.889	-4.58	5.22

Outcome Measure	Mean		Sig. (p value)	CI	
	Baseline	Post		Lower	Higher
Swallow Volume (ml)	23.7 (5.44)	24.5 (10.2)	0.688	-4.60	3.13
Swallow Capacity (ml/s)	23.2 (6.91)	21.9 (6.8)	0.119	-0.39	3.01
Time per Swallow (s)	1.06 (0.24)	1.11 (0.26)	0.431	-0.191	0.086
Swallowing Skill (PQ)	159.4 (104.1)	160.1 (84.6)	0.966	-35.6	34.2
Maximum Tongue Pressure (mmHg)	46.7 (11.7)	46.7 (12.9)	0.974	-3.72	3.60
Relative Tongue Pressure (mmHg)	40.5 (13.2)	46.7 (15.9)	0.889	-15.6	3.02

## Conclusion

In line with previous studies<sup>5</sup>, a single session of anodal tDCS increased FOM motor excitability, particularly at 30min and 60min following stimulation. The lack of changes in the functional measures was unexpected and requires further investigation. It is possible that the subtle changes in cortical excitability did not affect swallowing function or that the functional outcome measures employed were unable to detect such changes.

### \*Sneak Preview\*

We are currently evaluating the effects of anodal tDCS on swallow biomechanics using high-resolution impedance manometry. Preliminary findings (N=6) suggest that bolus admittance through the UES increases and UES peak pressure post-swallow decreases up to 30min following anodal tDCS.