Treatment of depression with transcranial magnetic stimulation using an H-coil (dTMS)

SBU ASSESSMENTS | ASSESSMENT OF METHODS IN HEALTH CARE AND SOCIAL SERVICES

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Summary and conclusions

This report is part of a government assignment regarding mental illnesses and consists of a systematic review of therapeutic effects and adverse events in the treatment of depression with deep transcranial magnetic stimulation (dTMS), which is a variant of repetitive transcranial magnetic stimulation (rTMS).

Background

Alternative treatments are needed for patients with depression who do not improve after treatment with antidepressant drugs or psychological treatment. One alternative is rTMS, where an electromagnetic coil is placed on the patient's head and repetitive pulses create a changing magnetic field that induces electric current that stimulates parts of the brain that are thought to be involved in the mechanisms of depression. dTMS is a variant of rTMS, in which a different shaped coil is used. The coil used in dTMS is referred to as an H-coil, whereas the most common coil type in rTMS is a figure-of-8 coil.

Aim

To assess the effects and adverse events of treating depression with dTMS. The questions asked were as follows:

- Does dTMS affect depression when the depressive state is assessed at the end of treatment or during follow-up sometime after the end of treatment?
- If dTMS has a statistically significant therapeutic effect, can maintenance treatment maintain this effect?
- What side effects and complications are there with dTMS treatment, and how common are they?

Conclusions

- It is uncertain how the effects of dTMS compare with those of rTMS with a figure-of-8 coil. There are no reliable studies comparing dTMS with other treatments for depression.
- Four weeks of treatment with dTMS compared with treatment with a sham coil results in an 11% increase in remission (between 1% and 22%) in patients with depression who were previously treated with antidepressants (⊕⊕◯◯). The long-term effects of dTMS treatment are uncertain.
- Epileptic seizures can occur during dTMS treatment, but they are uncommon. There are no indications of cognitive side effects. Reports of local pain increases with 22% (between 15% and 28%) in patients treated with dTMS compared to patients treated with a sham coil (⊕⊕⊕◯).

The intention behind the development of dTMS was to achieve a larger effect than that observed with the established treatment using rTMS with a figure-of-8-coil in patients previously treated with antidepressants. The effects of dTMS in comparison with other treatments have not been sufficiently evaluated; however, the effect size seems to be similar to that achievable with rTMS using a different coil type.

The studies evaluating dTMS have included different populations and different numbers of previous treatment attempts. The possibility that dTMS is more effective for specific groups of patients cannot be excluded, and it would be valuable to perform studies focusing on well-defined patient groups that currently lack suitable alternative treatments.

Method

This systematic review was conducted in accordance with the PRISMA statement. The protocol is registered in Prospero (CRD42020193623, https://www.crd.york.ac.uk/prospero/display_record.php?ID=-CRD42020193623). The certainty of evidence was assessed using GRADE (https://gdt.gradepro.org/app/handbook/handbook.html).

Inclusion criteria

Population: Patients with unipolar or bipolar depression according to DSM-III to DSM-5 or ICD-10 criteria.

Intervention: Transcranial magnetic stimulation with an H-coil.

Control: Sham coil, other treatments such as rTMS using a different coil type, ECT, or antidepressant drugs, or treatment with another dose of dTMS.

Outcome: Percentage of patients in remission, percentage of patients with a response or change in score on a depression-rating scale. Adverse events and complications of treatment.

Study design: Randomised controlled trials.

Search period: From 2014 to 2020. Final search on February 24, 2020.

Databases searched: Cochrane Library (Wiley), EMBASE (Embase.com), PsycINFO (EBSCO), PubMed (NLM).

A complementary search of Clinicaltrials.gov was performed in September 2020 for studies using dTMS for the treatment of depression.

Client/patient involvement: No.

Results

Five randomised clinical trials that described the effects and side effects of dTMS were included in this systematic review (Figure 1). These studies included 582 participants. The results of the assessment are summarised in Figure 1 and Table 1.

Figure 1 Flow chart of the article selection procedure.

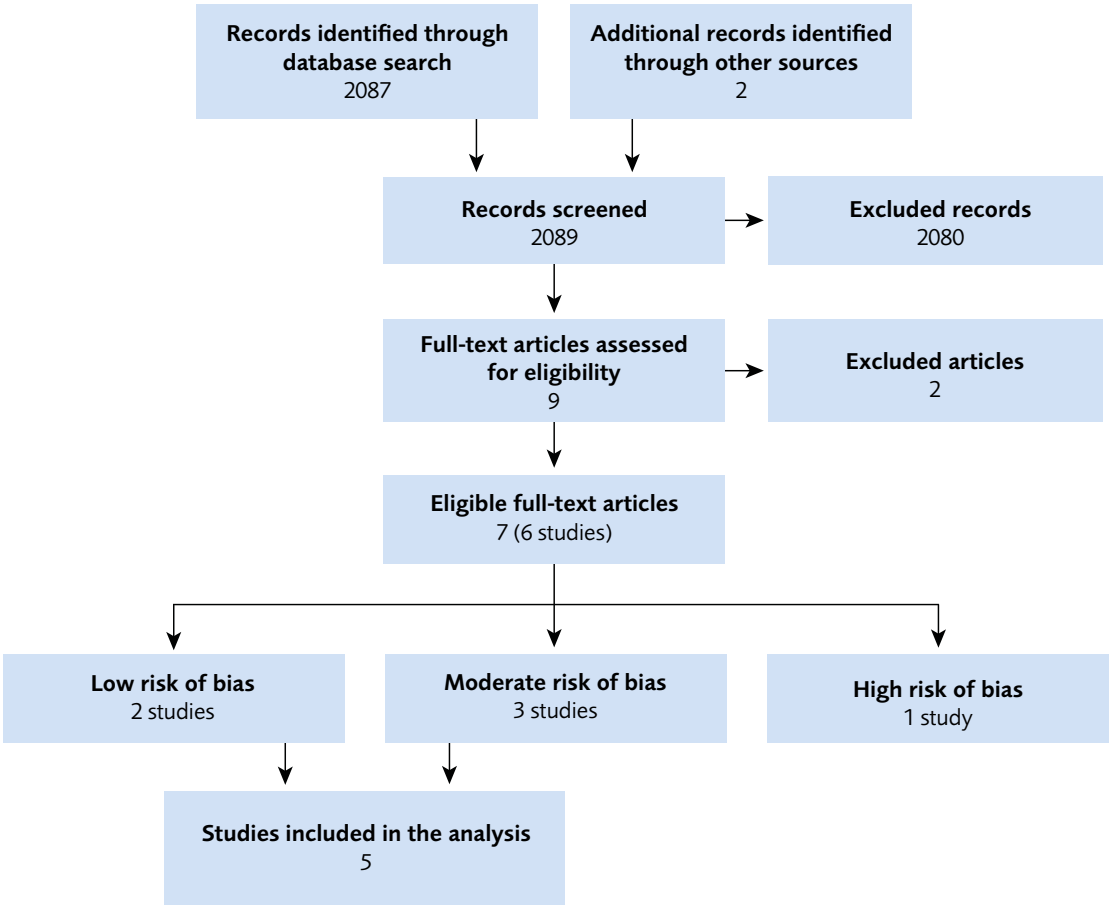

Table 1 Summary of findings

Outcome	Number of participants (Number of studies) Reference Study design	Result MD (SD)	Effect RR/RD or MD (95% CI)	Certainty of evidence	Deduction
dTMS compared with a sham coil at end of treatment					
Increase in the proportion achieving remission	354 (4) [1–4] RCT	dTMS: 0.26 (0.12) sham coil: 0.15 (0.01)	RD: 0.11 (0.01 to 0.22) (RR: 1.88 (1.22 to 2.88))	Low ⊕⊕◯◯	–1 risk of bias[1] –1 precision[2]
Increase in the proportion achieving a response	354 (4) [1–4] RCT	dTMS: 0.34 (0.17) sham coil: 0.20 (0.03)	RD: 0.13 (0.01 to 0.25) (RR: 1.72 (1.2 to 2.46))	Low ⊕⊕◯◯	–1 risk of bias[1] –1 precision[2]
Decrease in depression score	354 (4) [1–4] RCT	NA*	MD: –2.85 (–4.18 to –1.51)	Low ⊕⊕◯◯	–1 risk of bias[1] –1 precision[3]
dTMS compared with *r*TMS with a figure-of-8 coil					
Increase in the proportion achieving remission	147 (1) [5] RCT	dTMS: 0.60 *r*TMS: 0.43	RD: 0.17 (0.01 to 0.33) (RR: 1.40 (1.01 to 1.93))	Very low ⊕◯◯◯	–3 precision[4]
Increase in the proportion achieving a response	147 (1) [5] RCT	dTMS: 0.67 *r*TMS: 0.44	RD: 0.23 (0.07 to 0.38) (RR: 1.52 (1.12 to 2.05))	Very low ⊕◯◯◯	–3 precision[4]
Decrease in depression score	147 (1) [5] RCT	dTMS: –10 *r*TMS: –7	MD: –3.00 (–5.03 to –0.97)	Very low ⊕◯◯◯	–3 precision[4]
dTMS compared with a sham coil 4 weeks after end of treatment					
Proportion in remission	50 (1) [4] RCT	dTMS: 0.24 sham coil: 0.24	RD: 0.00 (–0.24 to 0.24) (RR: 1.00 (0.37 to 2.68))	Very low ⊕◯◯◯	–3 precision[4]
Increase in the proportion achieving a response	50 (1) [4] RCT	dTMS: 0.32 sham coil: 0.24	RD: 0.08 (–0.17 to 0.33) (RR: 1.33 (0.54 to 3.29))	Very low ⊕◯◯◯	–3 precision[4]
Decrease in depression score	50 (1) [4] RCT	dTMS: –9.32 sham coil: –6.08	MD: –2.76 (–8.24 to 2.72)	Very low ⊕◯◯◯	–3 precision[4]
Adverse events of dTMS compared with a sham coil					
Increase in the proportion with experience of local pain at the application site	335 (3) [1,4,6] RCT	dTMS: 0.20 (0.04) sham coil: 0.00 (0.00)	RD: 0.22 (0.15 to 0.28) (RR: 17.70 (4.30 to 72.81))	Moderate ⊕⊕⊕◯	–1 precision[3]

CI = *Confidence interval;* **MD** = *Mean difference;* **NA** = *Not applicable;* **RD** = *Risk difference;* **RR** = *Risk ratio;* **SD** = *Standard deviation.*

[1] *Deducion of 1 point for risk of bias due to uncertainties in the reporting, especially regarding the largest study, and because three of four studies were sponsored by the company that developed the product, and it is unclear how involved the company was in these studies.*

[2] *Deduction of 1 point for precision as there were few participants and few events in the studies.*

[3] *Deduction of 1 point for precision as there were few participants and studies.*

[4] *Deduction of 3 points for precision as there was only one study, which had few participants.*

* *Mean difference and standard deviation cannot be reported as the change in depression score was reported in different ways across the studies.*

The full report in Swedish

Read the full report "Behandling av depression med transkraniell magnetstimulering med H-spole (dTMS)" (in Swedish), www.sbu.se/318

References

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Appendices (www.sbu.se/318e)

- Search strategies
- Characteristics of included studies
- Risk of bias chart
- Excluded studies

Project group

Experts

Axel Nordenskjöld (Psychiatrist, Örebro University Hospital, Örebro)
Björn Mårtensson, (Psychiatrist, Karolinska institutet, Stockholm)

SBU

Susanne Johansson (Project Manager)
Agneta Pettersson (Assistant Project Manager)
Sara Fundell (Project Administrator)
Klas Moberg (Information Specialist)

External reviewers

Robert Bodén (Psychiatrist, Uppsala University Hospital, Uppsala)

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www.sbu.se/en • registrator@sbu.se
Graphic Design: Anna Edling, SBU