

# Repetitive Trans-Cranial Magnetic Stimulation (rTMS) for Cognitive Enhancement in Traumatic Brain Injury (TBI) patients: A Systematic Review and Meta-analysis.

**Introduction** Earlier, Cognitive Rehabilitation Therapy (CRT) focused on a restorative or compensatory approach. It is only recently that the repetitive Transcranial Magnetic Stimulation (rTMS) approach of CRT has been shown to stimulate cognitive networks to produce long-lasting cognitive enhancement in Traumatic Brain Injury (TBI) patients.

**Objectives** To determine the effectiveness of low-frequency rTMS for cognitive enhancement in TBI patients.

**Methods** PubMed (n=2), Trip Medical Database (n=6), and ClinicalTrials.gov (n=8) were searched using the keyword 'rTMS', 'TBI' and 'cognition'. Studies identified from inception were imported to EndNote X9 Library and duplicates removed post which RCTs conducted with TBI patients ( $\geq 18$  years) having undergone rTMS for Cognitive Enhancement compared against Sham controlled placebo groups were screened using title and abstract (n=9) and full text (n=9). Trail Making (TMT) Test Part-B & Montreal Cognitive Assessment (MoCA) Data could be extracted from 6 studies, and their meta-analysis was done in Review Manager 5.4.

**Results** Due to considerable heterogeneity ( $\text{Chi}^2 = 257.44$ ,  $p < 0.000001$ ,  $I^2 = 82\%$ ), inverse variance random effect meta-analysis was done. Cognitive enhancement scores of 154 patients from 6 studies revealed a pooled Standardized Mean Difference of 0.07 [95% CI -0.81, 0.94]. Test for overall effect  $Z = 0.15$  ( $P = 0.88$ ) indicates that there is no significant difference in cognitive outcomes between Sham controlled and rTMS patients. Overall cognitive enhancement reached statistical significance ( $Z = 20.53$  ( $P < 0.00001$ )) in sham control favoring sub-group (fixed effect meta-analysis ( $I^2 = 0\%$ )) as well as in

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rTMS favoring sub-group ( $Z = 2.79$  ( $P = 0.005$ )) (random effect meta-analysis ( $I^2 = 71\%$ )).

**Conclusion** The pooled evidence suggests that both interventions significantly improved cognitive outcomes among TBI patients, and rTMS does not have any significant benefit over Sham controlled groups for cognitive enhancement. The meta-analysis from our study shall guide treatment and future researchers.