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15 September 2021

Use of rTMS for improving Executive Functions in Attention Deficit Disorder : a review

Introduction :

Attention Deficit Disorder (ADD), a subtype of Attention Deficit Disorder with Hyperactivity (ADHD) that does not present hyperactivity as a symptom, is a common psychiatric disorder that has high societal costs [1] [2] . Currently, its primary treatment is pharmacological and is based on methylphenidate [1] [3] but other clinical approaches are explored such as repetitive Transcranial Magnetic Stimulation (rTMS) [4]. Thus, the purpose of this paper is to provide a concise review of what the studies on the topic have concluded so far.

Method :

Searches were made using specialised search engines such as Google Scholar and Microsoft Academic with the following boolean equation*
"rTMS" AND ("Attention Deficit Disorder" OR "Concentration Deficit Disorder")
All relevant articles from the results were included in this bibliography using ZoteroBib, the format of this biography is IEEE compliant.

*Except for [1] [2] and [5]

Discussions :

rTMS has shown to have effects on neural networks in somewhat surprising ways such as reducing contralateral extinction [5] and there is no reason for it to not be effective in ADD. Indeed some cases and studies seem to indicate that rTMS have a clear effect on symptoms [6] [7] however those studies lack strong protocols or group number to clear out other variables and more serious reviews still reiterate the fact there is no strong evidence of rTMS efficacy, probably due to a lack of standardisation of protocols [8] [9] [10]. A recent study shows great promises, mainly because it elaborates more on how to apply rTMS for improving attention but it still lacks a sheer group number [11]. In conclusion more efforts should be made toward defining protocols and standards for rTMS use to better measure its efficacy [12].

References :

[1] S. V. Faraone et al. 'The World Federation of ADHD International Consensus Statement: 208 Evidence-Based Conclusions about the Disorder'. *Neuroscience & Biobehavioral Reviews*, vol. 128, Sept. 2021, pp. 789–818. *ScienceDirect*, https://doi.org/10.1016/j.neubiorev.2021.01.022.

[2] K. Miller. 'ADD vs ADHD'. *WebMD*, https://www.webmd.com/add-adhd/childhood-adhd/add-vs-adhd. Accessed 15 Sept. 2021.

[3] M. Chen et al. 'Treatment-Resistant Attention-Deficit Hyperactivity Disorder: Clinical Significance, Concept, and Management'. *Taiwanese Journal of Psychiatry*, vol. 33, no. 2, Jan. 2019, p. 66. *www.e-tjp.org*, https://doi.org/10.4103/TPSY.TPSY_14_19.

[4] L. Brandejsky et al. 'Stimulation cérébrale non invasive dans le traitement du trouble déficit de l'attention avec ou sans hyperactivité : une revue de la littérature'. *L'Encéphale*, vol. 43, no. 5, Oct. 2017, pp. 457–63. *ScienceDirect*, https://doi.org/10.1016/j.encep.2016.08.011.

[5] R. C. Kadosh, editor. *The Stimulated Brain: Cognitive Enhancement Using Non-Invasive Brain Stimulation*. Elsevier/Academic Press, 2014.

[6] E. Asimoglou et al. 'Effects of Repetitive Transcranial Magnetic Stimulation in the Treatment of Attention-Deficit Hyperactivity Disorser: A Case Study'. *European Psychiatry*, vol. 64, no. S1, Apr. 2021, pp. S492–93. *Cambridge University Press*, https://doi.org/10.1192/j.eurpsy.2021.1317.

[7] R. K. Patel et al. 'Transcranial Magnetic Stimulation for Adolescents With ADHD'. *The Primary Care Companion for CNS Disorders*, vol. 23, no. 3, May 2021, pp. 0–0. *www.psychiatrist.com*, https://doi.org/10.4088/PCC.20br02602.

[8] K. Pushaneh et al. 'The Study of the Effect of Magnetic Therapy on Improvement of Neuropsychological Functions in Children with Attention Deficit Disorder and Hyperactivity'. *European Online Journal of Natural and Social Sciences: Proceedings*, vol. 2, no. 2s, July 2013, pp. 461–71.

[9] L. Salerno et al. 'Neuromodulation in Attention-Deficit/Hyperactivity Disorder: Toward a Precision Psychiatry Approach'. *Non Invasive Brain Stimulation in Psychiatry and Clinical Neurosciences*, edited by Bernardo Dell'Osso and Giorgio Di Lorenzo, Springer International Publishing, 2020, pp. 107–22. *Springer Link*, https://doi.org/10.1007/978-3-030-43356-7_9.

[10] F. H. Santos et al. 'Chapter 1 - Effects of Transcranial Stimulation in Developmental Neurocognitive Disorders: A Critical Appraisal'. *Progress in Brain Research*, edited by Roi Cohen Kadosh et al., vol. 264, Elsevier, 2021, pp. 1–40. *ScienceDirect*, https://doi.org/10.1016/bs.pbr.2021.01.012.

[11] M. Palaus, et al. *Cognitive Enhancement by Means of TMS: Memory and Executive Functions*. 2015, https://www.researchgate.net/profile/Marc-Palaus/publication/281776858_Cognitive_enhancement_by_means_of_TMS_memory_and_executive_functions/links/55f8017e08ae07629dce9fab/Cognitive-enhancement-by-means-of-TMS-memory-and-executive-functions.pdf.

[12] P. Sauseng and H. R. Liesefeld. 'Cognitive Control: Brain Oscillations Coordinate Human Working Memory'. *Current Biology*, vol. 30, no. 9, May 2020, pp. R405–07. *ScienceDirect*, https://doi.org/10.1016/j.cub.2020.02.067.