

Bölüm 15

TRANSKRANIAL MANYETİK STİMÜLASYONUN (TMS) NÖROLOJİDE TERAPÖTİK KULLANIMINA BAKIŞ VE GELECEĞİ

Zehra YAVUZ¹

GİRİŞ

Günümüzde non invaziv bir yöntem olan nörostimülasyon son yıllarda özellikle dirençli epileptik nöbetler başta olmak üzere bir dizi nörolojik alanda klinik faydası gösterilmiş güvenilir ve gelişime açık bir teröpatik yaklaşımdır. Deneysel uygulamaların çok ötesine geçmekle birlikte transkraniyal manyetik nörostimülasyon (TMS) ‘tamamlayıcı ve geleneksel uygulama’ kavramından uzaklaşmış olup, nöro bilim dünyasına potansiyel katkılarıyla umut vaad eder.

Transkraniyal Manyetik Stimülasyon (TMS)

1. Tanım

Transkraniyal manyetik stimülasyon (TMS) beynin patofizyolojik incelenmesi, fonksiyonel haritalanması, tanı ve bir terapötik prosedür olarak nörofizyolojik temellere dayalı noninvaziv modern nörostimülasyon ve nöromodulasyon tekniğidir. TMS beynin uyarılabilirliğinin ve bu etkinin ortaya çıkardığı değişikliklerin değerlendirilmesi sonucu çıkan verilerle nöro bilimlere katkı sunar.

Günümüzde TMS’nun nörofizyolojik etkileri ve sonuçlarının tanınmasıyla, cihazın teknik olarak gelişimi ve nörogörüntüleme modaliteleri birlikte kullanımını gelişime açık bir alan olarak cezbedicidir.

¹ Uzm. Dr., Nöroloji, Tokat Devlet Hastanesi, drzehrnrj@gmail.com

SONUÇ

Sonuç olarak; 1990'larda nörobilim dünyasına giren transkranyal manyetik stimülasyon (TMS) araştırma ve uygulamaları öngörülemez ve karmaşık kavramdan çok daha ötede kortikal aktivitenin modülasyonuna sihirli dokunuşları ile heyecan verici klinik ve prelinik endikasyonlar alanı yaratmıştır. TMS aynı zamanda hastalıkların patofizyolojisinin anlaşılmasına sunduğu katkılarıyla tanı ve tıbbi alandaki perspektifimizi de geliştirmiştir. Elektronörofizyoloji ve nöronavigasyon teknikleri ile desteklenmesi gelecekte yeterli veri sağlama ve optimizasyonu için önemlidir.

KAYNAKLAR

1. Levin KH, Chauvel P, Clinical neurophysiology Chapter 37 2019. eBook ISBN: 9780444640338
2. LB Merabet, A. Pascual-Leone, Transcranial Magnetic Stimulation, Encyclopedia of Neuroscience 2009, Pages 1055-1062, <https://doi.org/10.1016/B978-008045046-9.003132>
3. Nardone R, Versace V, Brigo F, Transcranial magnetic stimulation and gait disturbances in Parkinson's disease: A systematic review, June 2020 Neurophysiologie Clinique/Clinical Neurophysiology 50(3) DOI: 10.1016/j.neucli.2020.05.002
4. Lefaucheur JP, André-Obadia N, Antal A, Evidence-based guidelines on the therapeutic use of repetitive transcranial magnetic stimulation (rTMS). Clin. Neurophysiol. 125, (2014). 2150–2206. doi: 10.1016/j.clinph.2014.05.021
5. León Ruiz M, Rodríguez Sarasa ML, Sanjuán Rodríguez L, S. Current evidence on transcranial magnetic stimulation and its potential usefulness in post-stroke neurorehabilitation: Opening new doors to the treatment of cerebrovascular disease. Neurologia. 2018 Sep;33(7):459-472.
6. Yang C, Guo Z, Peng H, et al. Repetitive transcranial magnetic stimulation therapy for motor recovery in Parkinson's disease: A Meta-analysis. Brain Behav. 2018;8(11):e01132. doi:10.1002/brb3.1132
7. Ren CL, Zhang GF, Xia N et al. Effect of low-frequency rTMS on aphasia in stroke patients: a meta-analysis of randomized controlled trials. PLoS One, 2014 9, e102557. doi:<http://dx.doi.org/10.1371/journal.pone.0102557>.
8. Barwood CH, Murdoch BE, Whelan BM, et al. The effects of low frequency Repetitive Transcranial Magnetic Stimulation (rTMS) and sham condition rTMS on behavioural language in chronic non-fluent aphasia: Short term outcomes. NeuroRehabilitation. 2011;28(2):113-28. doi: 10.3233/NRE-2011-0640
9. Barwood CH, Murdoch BE, Riek S et al. Long term language recovery subsequent to low frequency rTMS in chronic non-fluent aphasia. NeuroRehabilitation. 2013;32(4):915-28. doi: 10.3233/NRE-130915
10. Abo M, Kakuda W, Watanabe M, Et al. Effectiveness of low-frequency rTMS and intensive speech therapy in poststroke patients with aphasia: a pilot study based on evaluation by fMRI in relation to type of aphasia. Eur. Neurol. 68, 199–208. (2012). doi: 10.1159/000338773

11. Gergely Silasi, Timothy H. Murphy, Stroke and the Connectome: How Connectivity Guides Therapeutic Intervention, *Neuron*, Volume 83, Issue 6, 2014, Pages 1354-1368 ISSN 0896-6273, <https://doi.org/10.1016/j.neuron.2014.08.052>.
12. Shah P. P, Szaflarski J. P, Allendorfer, et al. Induction of neuroplasticity and recovery in post-stroke aphasia by non-invasive brain stimulation. *Front. Hum. (2013) Neurosci.* 7:888. doi: 10.3389/fnhum.2013.00888
13. P.M. Rossini, A.T. Barker, A. Berardelli, et al. Non-invasive electrical and magnetic stimulation of the brain, spinal cord and roots: basic principles and procedures for routine clinical application. Report of an IFCN committee, *Electroencephalography and Clinical Neurophysiology*, Volume 91, Issue 2, 1994, Pages 79-92, ISSN 0013-4694, [https://doi.org/10.1016/0013-4694\(94\)90029-9](https://doi.org/10.1016/0013-4694(94)90029-9).
14. Thiel A, Hartmann A, Rubi-Fessen I, et al. Effects of noninvasive brain stimulation on language networks and recovery in early poststroke aphasia. *Stroke* 44, 2240–2246. doi: 10.1161/STROKEAHA.111.000574
15. Alqahtani F, Imran I, Pervaiz H, et al. Non-pharmacological Interventions for Intractable Epilepsy. *Saudi Pharm J.* 2020;28(8):951-962. doi:10.1016/j.jsps.2020.06.016
16. Mishra A, Maiti R, Mishra BR, et al. Effect of repetitive transcranial magnetic stimulation on seizure frequency and epileptiform discharges in drug-resistant epilepsy: a meta-analysis. *J Clin Neurol.* 2020;16(1):9–18.
17. Ellrich J. Cortical stimulation in pharmacoresistant focal epilepsies. *Bioelectron Med.* 2020;6:19. Published 2020 Sep 25. doi:10.1186/s42234-020-00054-4
18. Lefaucheur JP, Aleman A, Baeken C, et al. Evidence-based guidelines on the therapeutic use of repetitive transcranial magnetic stimulation (rTMS): an update (2014-2018). *Clin Neurophysiol.* 2020; 131(2):474–528.
19. Khedr EM, Abo-Elfetoh N, Rothwell JC, et al. Contralateral versus ipsilateral rTMS of temporoparietal cortex for the treatment of chronic unilateral tinnitus: comparative study. *Eur J Neurol* 2010a;17:976–83.
20. Kim BG, Kim DY, Kim SK, et al.. Comparison of the outcomes of repetitive transcranial magnetic stimulation to the ipsilateral and contralateral auditory cortex in unilateral tinnitus. *Electromagn Biol Med* 2014. [http:// dx.doi.org/10.3109/15368378.2013.801353](http://dx.doi.org/10.3109/15368378.2013.801353).
21. Thut G and Pascual-Leone A. A review of combined TMS-EEG studies to characterize lasting effects of repetitive TMS and assess their usefulness in cognitive and clinical neuroscience. (2010) *Brain Topogr.* 22:219. doi: 10.1007/s10548-009-0115-4
22. Iglesias, A.H. Transcranial Magnetic Stimulation as Treatment in Multiple Neurologic Conditions. *Curr Neurol Neurosci Rep* 20, 1 (2020) <https://doi.org/10.1007/s11910-020-1021-0>
23. Weiler M, Stieger KC, Long JM, Transcranial Magnetic Stimulation in Alzheimer's Disease: Are We Ready? *eNeuro* 2020;7.<https://doi.org/10.1523/ENEURO.0235-19.2019>.
24. Ahmed MA, Darwish ES, Khedr EM, El Serogy YM, Ali AM. Effects of low versus high frequencies of repetitive transcranial magnetic stimulation on cognitive function and cortical excitability in Alzheimer's dementia. *J Neurol.* 2012 Jan;259(1):83-92. doi: 10.1007/s00415-011-6128-4
25. Koch G, Martorana A, Caltagirone C Transcranial magnetic stimulation: emerging biomarkers and novel therapeutics in Alzheimer's disease. *Neurosci Lett.* Advance online publication. Retrieved December 16, 2019. doi:10.1016/j.neulet.2019.134355

26. Cullen CL, Senesi M, Tang AD, Low-intensity transcranial magnetic stimulation promotes the survival and maturation of newborn oligodendrocytes in the adult mouse brain. (2019) *Glia* 67:1462-1477.
27. Malavera A, Silva FA, Fregni F, et al. Repetitive transcranial magnetic stimulation for phantom limb pain in land mine victims: a doubleblinded, randomized, sham-controlled trial. *J Pain*. 2016;17(8):911-8
28. Caeyenberghs K, Duprat R, Leemans A, et al. Accelerated intermittent theta burst stimulation in major depression induces decreases in modularity: a connectome analysis. (2019) *Netw Neurosci* 3:157-172
29. Chervyakov AV, Bakulin IS, Savitskaya NG, et al. Navigated transcranial magnetic stimulation in amyotrophic lateral sclerosis. *Muscle Nerve*. 2015;51(1):125-31. <https://doi.org/10.1002/mus.24345>.
30. Ganguly J, Murgai A, Sharma S, et al. Non-invasive Transcranial Electrical Stimulation in Movement Disorders. *Front Neurosci*. 2020;14:522. Published 2020 Jun 5. doi:10.3389/fnins.2020.00522
31. Chiu D, McCane CD, Lee J, et al. Multifocal transcranial stimulation in chronic ischemic stroke: A phase 1/2a randomized trial. *J Stroke Cerebrovasc Dis*. 2020 Jun;29(6):104816. doi: 10.1016/j.jstrokecerebrovasdis.2020.104816. Epub 2020 Apr 19. PMID: 32321651.
32. Van Haerents S, Chang BS, Rotenberg A, et al. Noninvasive Brain Stimulation in Epilepsy. *J Clin Neurophysiol*. 2020 Mar;37(2):118-130. doi: 10.1097/WNP.0000000000000573
33. Moisset X, Lefaucheur JP. Non pharmacological treatment for neuropathic pain: Invasive and non-invasive cortical stimulation. *Rev Neurol (Paris)*. 2019 Jan-Feb;175(1-2):51-58. doi: 10.1016/j.neurol.2018.09.014
34. Gaede G, Tiede M, Lorenz I, et al. Safety and preliminary efficacy of deep transcranial magnetic stimulation in MS-related fatigue. *Neurol Neuroimmunol Neuroinflamm*. 2017;5(1):e423. <https://doi.org/10.1212/NXI.0000000000000423>
35. Lan L, Zhang X, Li X, et al. The efficacy of transcranial magnetic stimulation on migraine: a meta-analysis of randomized controlled trails. *J Headache Pain*. 2017;18(1):86. Published 2017 Aug 22. doi:10.1186/s10194-017-0792-4