



Topic Exploration Report

Topic explorations are designed to provide a high-level briefing on new topics submitted for consideration by Health Technology Wales. The main objectives of this report are to:

- Determine the quantity of evidence available for a technology of interest.
- Identify any gaps in the evidence.
- Inform decisions on topics that warrant fuller assessment by Health Technology Wales (HTW).

Topic exploration report number:	TER317
Topic:	Single pulse transcranial magnetic stimulation for the acute treatment or prevention of migraines
Summary of findings:	Multiple sources of evidence were found on the single pulse transcranial magnetic stimulation (sTMS) for the acute treatment or prevention of migraines. These include two technology assessments or guidance and two systematic reviews all presenting evidence from a total of four primary studies. Only one of the four studies was a randomised controlled trial (RCT). The evidence appears to consider both the treatment and prevention of migraine. Overall, evidence suggests that sTMS may have a positive impact on migraine prevention and treatment, but the current evidence base is limited.

Introduction and aims

Migraine is a common condition characterised by recurrent, unilateral or bilateral headaches, often accompanied by nausea and sensitivity to light and sound. Migraines can be preceded by an aura which can include visual, olfactory or speech disturbances. The condition is often characterised as either episodic (acute) migraines or chronic migraines, depending on headache frequency; both often require acute treatment during a migraine attack. Single pulse transcranial magnetic stimulation (sTMS) aims to treat or prevent migraine episodes through the delivery of a single magnetic pulse from a portable, handheld device.

Health Technology Wales researchers searched for evidence on sTMS for the acute treatment or prevention of migraines. We did not include evidence on repetitive TMS (rTMS).

Evidence overview

Technology Assessment/Guidance

The National Institute for Health and Care Excellence (NICE) Interventional Procedures Guidance 477 (IPG477) on “Transcranial magnetic stimulation for treating and preventing migraine” evaluated the efficacy and safety of TMS for the use during the aura, before a migraine episode or at the start of a migraine episode (NICE 2014). This included both sTMS and repetitive TMS. The guidance highlights that the evidence on the efficacy of TMS for the treatment of migraine was limited in quantity, and for the prevention of migraine was limited in both quantity and quality. The evidence on its safety is adequate for short and medium term use but uncertain for long-term or frequent use. Therefore NICE recommends that TMS should only be used with special arrangements for clinical governance, consent and audit or research.

Only one randomised controlled trial (RCT) and one case series identified by the guidance focuses on the use of sTMS:

- Lipton et al. (2010) is a multicentre randomised controlled trial (RCT) of 164 participants treated for at least one attack of migraine with aura with sTMS (n=82) or sham treatment (n=82). Pain-free rates 2 hours after stimulation were significantly better with sTMS than sham (39% versus 22%), and this was sustained at 24 hours (29% versus 16%) and 48 hours (27% versus 13%). No difference was observed in other secondary outcomes (headache response at 2 hours, use of rescue drugs, Migraine Disability Assessment [MIDAS] score and consistency of pain relief response).
- Clarke et al. (2006) was a single centre case series of 42 participants who received either low or high frequency sTMS. Overall, pain decreased by 75% from baseline after sTMS treatment.

The Scottish Intercollegiate Guidelines Network (SIGN) clinical guideline 155 on “Pharmacological management on migraine” reports findings on sTMS when used for migraine therapy (SIGN 2018). Only one RCT was identified on the acute treatment of migraine, which was the same study reported in the NICE IPG477 by Lipton et al. (2010).

Evidence reviews

Two systematic reviews that evaluate sTMS as a neurostimulation method for the acute treatment or prevention of migraines have been identified. These include:

- Moisset et al. (2020), a systematic review and meta-analysis of RCTs of neuromodulation techniques for acute and preventive migraine treatments. The authors only report the study by Lipton et al. (2010) for the treatment of acute migraine with aura using sTMS.

- Stilling et al. (2019) identified four studies on the use of sTMS for the treatment of migraine. Two of these studies are the Lipton et al. (2010) and Clarke et al. (2006) described above. Bhole et al. (2015) was UK post-marketing authorisation program, which reported real world data on use of sTMS in routine clinical practice for acute migraine treatment (n = 190 at final 3 month follow up). The remaining study by Starling et al. (2018) (n=220) reported observational data from the US on sTMS for the prevention of migraines.

Overall, the systematic reviews concluded that sTMS could have a positive effect on migraine and could be an effective and well-tolerated treatment for migraine prevention.

Economic evaluations

Brüggenjürgen et al. (2016) provides an incremental cost analysis of TMS versus Botox, but for refractory chronic migraine patients. Analysis were for both UK individual funding requests as well as for an average UK specialist centre setting. The cost impact results were derived from a decision-tree model simulating treatment pathways over the course of one year. Authors concluded that use of TMS for chronic refractory migraine results in a substantial cost reduction when compared with Botox.

Areas of uncertainty

Despite the body evidence found, multiple areas of uncertainty remain to be elucidated if this topic were to proceed to fuller appraisal. These include:

- Whether an appraisal should focus on acute treatment, prevention, or both.
- Whether it is appropriate or feasible to report migraine subgroups (acute or chronic) separately (this may not be possible in mixed population studies where subgroup outcomes are not reported).
- What constitutes current standard of care for the acute/chronic migraine in Wales and what criteria (if any) are applied to determine whether sTMS should be offered?
- What economic analysis would be feasible or appropriate based on the current evidence.

Literature search results

Health technology assessments and guidance

NICE. (2014). Transcranial magnetic stimulation for treating and preventing migraine [IPG477]. National Institute for Health and Care Excellence. Available at: <https://www.nice.org.uk/guidance/ipg477> [Accessed 03.11.2021].

SIGN. (2018). Pharmacological management of migraine [SIGN155]. Scottish Intercollegiate Guidelines Network. Available at: <https://www.sign.ac.uk/our-guidelines/pharmacological-management-of-migraine/> [Accessed 03.11.2021].

Evidence reviews and economic evaluations

Clark O, Mahjoub A, Osman N, et al. (2021). Non-invasive neuromodulation in the acute treatment of migraine: a systematic review and meta-analysis of randomized controlled trials. *Neurological sciences : official journal of the Italian Neurological Society and of the Italian Society of Clinical Neurophysiology*. doi: 10.1007/s10072-021-05664-7

Feng Y, Zhang B, Zhang J, et al. (2019). Effects of Non-invasive Brain Stimulation on Headache Intensity and Frequency of Headache Attacks in Patients With Migraine: A Systematic Review and Meta-Analysis. *Headache*. 59(9): 1436-47. doi: 10.1111/head.13645

Moisset X, Pereira B, Ciampi de Andrade D, et al. (2020). Neuromodulation techniques for acute and preventive migraine treatment: a systematic review and meta-analysis of randomized controlled trials. *The journal of headache and pain*. 21(1): 142. doi: 10.1186/s10194-020-01204-4

Stilling JM, Monchi O, Amoozegar F, et al. (2019). Transcranial Magnetic and Direct Current Stimulation (TMS/tDCS) for the Treatment of Headache: A Systematic Review. *Headache*. 59(3): 339-57. doi: 10.1111/head.13479

Relevant evidence submitted by the topic proposer

Brüggenjürgen B, Baker T, Bhogal R, et al. (2016). Cost impact of a non-invasive, portable device for patient self-administration of chronic migraine in a UK National Health Service setting. *SpringerPlus*. 5(1): 1-7.

Date of search:

November 2021

Concepts used:

Transcranial magnetic stimulation AND migraine