

TRANSCRANIAL PULSE STIMULATION (TPS) IN PSYCHIATRY

Oliver Seemann

Spitäler Schaffhausen, Psychiatriezentrum Breitenau, Schaffhausen, Switzerland.

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Abstract: TPS is a physical technique with a pulsed shock wave (Fig. 1, 2). Since 2018, it is approved as treatment against mild to moderate dementia of Alzheimer's type. After initial positive experiences with TPS in dementia, we have expanded the therapy spectrum off-label to the treatment of therapy-resistant depressive symptoms. We also discovered that TPS is capable of provoking a vagotonic reaction in the sense of vagus nerve stimulation. Due to the pathogenetic similarities of dementia and schizophrenia, we have treated corresponding patients with TPS and had first positive experiences in the treatment of positive symptoms and agitation.

Keywords: pulsed shock wave, dementia, vagotonic reaction, Alzheimer

Introduction

Psychiatriezentrum Breitenau offers inpatient, day clinic and outpatient treatment services as well as long-term psychiatry. In the Department of Interventional Psychiatry, TMS (transcranial magnetic stimulation) and ECT (electro-convulsive therapy) are long time established as treatment methods.

In May 2022, we started TPS treatment of the first patients with Alzheimer's type dementia.

Since there are similarities in network pathology (e.g. hippocampal atrophy) between dementia and depression, it was obvious - analogous TMS (1) - to use the procedure off-label also in depressive patients (2, 3, 4), especially in those who did not respond to TMS/ECT.



Figure 1. TPS shock wave

As part of the search for the optimal spot of depression treatment, we have also been able to induce vagus nerve stimulation (more precisely: vagotonic reaction), with spontaneous pulse drop. We interpreted this as stimulation of cortical-subcortical networks.

Now that it was evident to us that TPS also has a network effect and that there are similarities in the network pathology of frontotemporal dementia and schizophrenia (“dementia praecox”) (5), we have now also started with the treatment of the first schizophrenic patients.

According to our knowledge, there are similarities in the mechanism of action of TPS and TMS, so we start to combine both methods (2).



Figure 2. Neurolith YPS machine

Material and methods

On-Label Dementia:

In total, we treated 6 patients with dementia under state-of-the-art therapy with TPS (Neurolith TPS, Storz Medical, 0.15- 0.2mJ/mm², frequency 4 Hz, 6000 pulses per session, stimulation frontal/parietal/precuneus). There were two treatment series 10 weeks apart, each with 6 sessions in 2-4 weeks.



Figure 3. TPS, F3



Figure 4. TPS, P8

Off-Label Depression:

A total of 9 patients were treated with TPS over F3. (0.15 mJ/ mm², frequency 4 Hz, 6000 pulses per session, 6 sessions in 2 weeks).

Vagus nerve stimulation (VNS):

In 5 patients, TPS was performed above the range P8/CP6 (Fig. 4) and the pulse was measured using a finger pulse oximeter.

Schizophrenia:

In a patient with auditory hallucinations and a patient with severe restlessness, the above-mentioned state-of-the-art stimulation protocol of TPS used in dementia.

Combination of TPS and TMS:

A patient with post-COVID-19 depression was treated with TPS (depression protocol see above) and TMS (Mag Pro R30, Magventure, round coil MCF 125, 1Hz, 100 % MT, 1500 stimuli, stimulation site P8, 30 min per session, 3x/week).

Results

Dementia:

In the case of our first index patient, in addition to subjectively improved psychomotor agitation and improved speech production, there was an improvement in MMSE of initially 21 points to 25 points after 6 treatments. The MMSE after completion of the second treatment series (10 weeks after treatment series 1) resulted in a value of 27 points.

Clinically, a total of five out of six patients showed an inconsistent improvement in symptoms (psychomotor agitation, word finding, short-term memory, attention).

Depression:

In all nine patients with treatment-refractory depression, there was an improvement in clinical symptoms (relaxation, improvement of mood and sleep), albeit often only in the short term and not always significantly.

Vagus nerve stimulation:

It showed reproducibly a partly significant pulse drop.

Schizophrenia:

The use of TPS in a patient with schizophrenia resulted in reduced voice hearing, in one patient a reduced psychomotor agitation.

Combination of TPS and TMS:

The use of combined TMS and TPS therapy in a patient with post-Covid-19 depression resulted in improved scores in the anxiety and depression assessments (2).

Discussion

Our findings are consistent with published studies on the effectiveness of TPS treatment for Alzheimer's type dementia (4, 6, 7, 8) and depression (3).

Due to the limited number of patients and short observation period, randomized controlled trials on clinical efficacy are useful and necessary. Adverse effects were marginally noticeable in our patients (mild pain).

Conclusion

The implementation of TPS in the Department of Interventional Psychiatry at the Schaffhausen Hospitals enables a promising treatment approach, in particular to avoid drug polypragmasy, as an add-on and, if necessary, in combination with TMS for various therapy-resistant symptoms, even if this is currently still an off-label use.

References

1. Murphy K, Khan A, Bachu A, Tampi R. Treatment of behavioral and psychological symptoms of dementia using transcranial magnetic stimulation: a systematic review. *Int Psychogeriatr*. 2023 Feb 20;1-12. doi: 10.1017/S1041610223000091. Epub ahead of print. PMID: 36803624.
2. Seemann O, Hechinger S, Krämer B, Combination of tps and tms in a patient with post covid-19 depression, *Brain Stimulation*, Volume 16, Issue 1, 2023, Page 236, ISSN 1935-861X

3. Cheung T, Li TMH, Ho YS, Kranz G, Fong KNK, Leung SF, Lam SC, Yeung WF, Lam JYT, Fong KH, Beisteiner R, Xiang YT, Cheng CPW. Effects of Transcranial Pulse Stimulation (TPS) on Adults with Symptoms of Depression-A Pilot Randomized Controlled Trial. Int J Environ Res Public Health. 2023 Jan 28;20(3):2333. doi: 10.3390/ijerph20032333. PMID: 36767702; PMCID: PMC9915638.

4. Matt E, Dörl G, Beisteiner R. Transcranial pulse stimulation (TPS) improves depression in AD patients on state-of-the-art treatment. Alzheimer's dementia (N Y). 2022 Feb 10;8(1):E12245. doi: 10.1002/trc2.12245. PMID: 35169611; PMCID: PMC8829892.

5. Exploring Links Between Psychosis and Frontotemporal Dementia Using Multimodal MachineLearning: Dementia Praecox Revisited. Koutsouleris N, et al. JAMA Psychiatry. 2022 Sep 1;79(9):907-919

6. Beisteiner R, Matt E, Fan C, Baldysiak H, Schönfeld M, Philippi Novak T, Amini A, Aslan T, Reinecke R, Lehrner J, Weber A, Reime U, Goldenstedt C, Marlinghaus E, Hallett M, Lohse-Busch H. Transcranial Pulse Stimulation with Ultrasound in Alzheimer's Disease-A New Navigated Focal Brain Therapy. Adv Sci (Weinh). 2019 Dec 23;7(3):1902583. doi: 10.1002/advs.201902583. PMID: 32042569; PMCID: PMC7001626.

7. Popescu T, Pernet C, Beisteiner R. Transcranial ultrasound pulse stimulation reduces cortical atrophy in Alzheimer's patients: A follow-up study. Alzheimer's dementia (N Y). 2021 Feb 25;7(1):e12121. doi: 10.1002/trc2.12121. PMID: 33681449; PMCID: PMC7906128.

8. Cont C, Mare N, Galli A, Schulte C, Logmin K, Trenado C, Wojtecki L. Retrospective real-world pilot data on transcranial pulse stimulation in mild to severe Alzheimer's patients. Front Neurol. 2022 Sep 14;13:948204. doi: 10.3389/fneur.2022.948204. PMID: 36188380; PMCID: PMC9515314.

Оливер Зеemann - ТРАНСКРАНИАЛЬНАЯ ИМПУЛЬСНАЯ СТИМУЛЯЦИЯ (ТПС) В ПСИХИАТРИИ. ТПС – это физическая методика с импульсной ударной волной. С 2018 года он одобрен для лечения легкой и умеренной деменции типа болезни Альцгеймера. После положительного опыта применения TPS при деменции мы расширили спектр терапии для лечения резистентных к терапии депрессивных симптомов. Мы также обнаружили, что TPS способен провоцировать стимуляцию блуждающего нерва. Из-за патогенетического сходства деменции и шизофрении мы лечили соответствующих пациентов с TPS и имели первый положительный результат.

Ключевые слова: импульсная ударная волна, деменция, ваготоническая реакция, болезнь Альцгеймера

Օլիվեր Չեման - ՏՐԱՆՏՐԱՆԻԱԿԱԼ ԻՄՊՈՒԼՍԱՅԻՆ ԽՌՁՆՈՒՄԸ (TPS)

ՀՈԳԵԲՈՒԺՈՒԹՅԱՆ ՄԵՉ: TPS-ը իմպուլսային հարվածային ալիքով ֆիզիկական տեխնիկա է, որը 2018 թվականին հաստատվել է Ալցհեյմերի տիպի մեղմ և միջին ծանրության տևաբանության բուժման համար: Մենք ընդլայնել ենք թերապիայի շրջանակը՝ կայուն դեպրեսիվ ախտանիշների վերացման համար: Նաև պարզել ենք, որ TPS-ը կարող է առաջացնել վազոտոնիկ արձագանք: Դեմենցիայի և շիզոֆրենիայի միջև պաթոգենետիկ նմանությունների պատճառով մենք համապատասխան հիվանդներին բուժել ենք TPS-ով և ունեցել ենք գրգռվածության բուժման առաջին դրական փորձը:

Հիմնաբառերը՝ իմպուլսային հարվածային ալիք, դեմենցիա, վազոտոնիկ ռեակցիա, Ալցհեյմերի հիվանդություն