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XIII International Symposium of Neuromodulation: Conference Abstracts

International Symposium of Neuromodulation Scientific Team[1] on behalf of participants.

[1]*Instituto SCALA, Sao Paulo, Brazil.*
**Corresponding author: Felipe Fregni, MD. Instituto SCALA, Sao Paulo, Brazil. Email: Felipe.Fregni@gmail.com*

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Poster Sessions

I. Motor Rehabilitation

I.1. Protocol-dependent effect of noninvasive brain stimulation on upper limb function in people with chronic stroke

Raylene Pires[1], *Gabriel Antonino[1], Paz Sánchez[1], Rebeca Dias[1], Adriana Baltar[1], Kátia Monte-Silva[1].*
1.Laboratory of Applied Neuroscience – Universidade Federal de Pernambuco – Recife – Brazil.

Objective: To systematically review how session number and stimulation dose of noninvasive brain stimulation (NIBS) influence the stimulation effectiveness in promoting the upper limb function in people with chronic post-stroke.
Methods: Electronic databases were searched for randomized controlled trials using transcranial direct current stimulation (tDCS) and repetitive transcranial magnetic stimulation (rTMS) for upper limb as rehabilitation tools. Meta-analyses with subgroups analyses were performed to identify which number of sessions (few or more than 10 sessions) and stimulation dose (rTMS: few or more than 1200 pulses; tDCS: few or more than 2mA) yielded the greatest impact on upper limb recovery.
Results: Fitty and three moderate to high-quality studies (2179 people with stroke) were included. In general, the rTMS and tDCS applied for more than 10 sessions (tDCS: SMD=2,98; 95%CI=2,43-3,54 and rTMS: SMD=4,03; 95%CI=3,04-5,02) seems to benefit more than fewer sessions (tDCS: SMD=0,37; 95%CI =-3,31-4,05 e rTMS: SMD=4,51; 95%CI =3,43-5,58). In contrast to rTMS, only tDCS applied for more than 10 sessions led to a significant improvement. Regarding stimulation dose, greater dose led to greater improvements (Pulses >1200 – SMD: 0,73 e 95%CI:0,39-1,08 vs. ≤ de 1200– SMD:-0,01 e 95%CI:-0,36-0,33; intensity>2mA–SMD:0,50; 95%CI:0,01-0,99 vs. ≤2mA– SMD:0,41 e 95%CI:-0,04-0,85).
Conclusions: Our results demonstrate that tDCS and rTMS promote upper limb recovery chronic post-stroke. However, NIBS effectiveness seems to depend on the stimulation protocol.
Funding: None
Conflict of Interest: None

I.2. Transcranial direct current stimulation (tDCS) in individuals with serious traumatic brain injury in the sub-acute phase: a series of cases

Bárbara Naeme de Lima Cordeiro[1], *Elizângela Kuster[2], Fernando Zanela Areas[2].*
1.Laboratório de Neurorreabilitação e Neuromodulação, Universidade Federal do Espírito Santo, Departamento de Ciências Fisiológicas, Vitória, ES, Brasil;
2.Universidade Federal do Espírito Santo, Departamento de Educação integrada em Saúde, Vitória, ES, Brasil.

Objective: Determining the effect of applying a tDCS protocol in individuals with severe TBI from the in-hospital subacute phase to discharge, on improving cognitive function and functional independence.
Methods: This is a series of cases, which included four individuals who were discharged from the Intensive Care Unit of a trauma referral hospital and who had a Glasgow Coma Scale (GCS) score < or = 8 on the admission or at some point during hospitalization. Participants received tDCS sessions every day and pre and post evaluations to viable applications during the

hospital stay. Participants received tDCS sessions every day and pre and post evaluations to viable applications during the hospital stay.

Results: The sample consists of four individuals, all male, with a mean age of 37.5 years (table 1). Descriptive statistics were calculated for the variables in the evaluations performed (figure 1).

Conclusions: In summary, this study supports the usefulness of tDCS in the setting of severe TBI in the in-hospital phase, in improving cognitive function and functional independence. A larger-scale study with a control group is needed to confirm the findings of this first experiment.

Funding: Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES).

Conflict of Interest: None

T**able 1.** Characterization of the sample.

Subject	1	2	3	4
Sex	M	M	M	M
Age	68	29	29	24
Color	Branco	Preto	Preto	Preto
Scholarity	IES	IES	IES	IES
TBI date	11/06/21	11/06/21	03/06/21	28/07/21
TBI cause	Bike vs. motorcycle collision	Motorcycle vs. post collision	auto vs auto collision	motorcycle vs ravine collision
Admission GOS	14	14	3	15
GOS <or = 8	19/06/21	11/06/21	-	28/07/21
Admission to the ward	04/07/21	04/08/21	12/07/21	21/08/21

M: male; EFI: incomplete elementary school; GOE: Glasgow Outcome Scale.

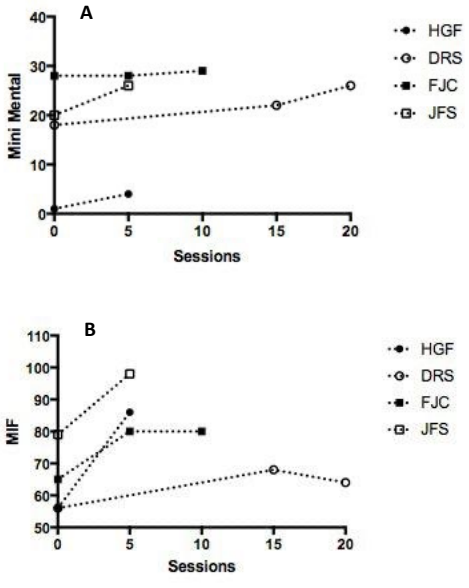

Figure 1. A: cognitive function at different moments of assessment. B: functional independence at different moments of assessments.

I.3. Transcranial direct current stimulation provides no clinically important benefits over walking training for improving walking in parkinson's disease: a systematic review

*Lucas Rodrigues Nascimento[1,2], Willian Assis do Carmo[3], Gabriela Pinto de Oliveira[3], Bárbara Naeme de Lima Cordeiro[4],Fernanda Moura Vargas Dias[3], **Elizangela Kuster[3]**,Fernando Zanela da Silva Areas[4]*

1. Federal University of Espírito Santo, Department of Integrated Health Education, Vitória, ES, Brazil.

2. NeuroGroup, Discipline of Physiotherapy, Federal University of Minas Gerais, Belo Horizonte, Brazil.

3. Universidade Federal do Espírito Santo, Departamento de Educação integrada em Saúde, Vitória, ES, Brasil

4. Laboratório de Neurorreabilitação e Neuromodulação, Universidade Federal do Espírito Santo, Departamento de Ciências Fisiológicas, Vitória, ES, Brasil.

Objective: Systematic review with meta-analyses of randomized clinical trials. Questions: Does walking training combined with transcranial direct current stimulation (tDCS) improve walking and reduce falls and freezing, compared to no intervention, in people with Parkinson's? Is walking training combined with tDCS superior to walking training alone? Are benefits transferred to social participation and/or maintained beyond the intervention period?

Methods: Participants: Adult outpatients with a clinical diagnosis of Parkinson's disease. Intervention: tDCS combined with walking training. Outcome measures: The primary outcomes were walking speed, cadence, and stride length. Secondary outcomes were number of falls, fear of falling, freezing of gait and social participation.

Results: 5 studies involving 117 participants were included. The mean PEDro score of the included trials was 8 out of 10. Participants performed the training for 30 to 60 minutes, two to three times a week, for an average of 4 weeks. Moderate-quality evidence indicated that the addition of tDCS to walking training produced negligible additional benefit over the effect of walking training alone on walking speed (MD −0.01 m / s, 95% CI −0.05 to 0 .04), step length (MD 1.2 cm, 95% CI −1.2 to 3.5) or cadence (MD −3 steps / minute, 95% CI −6 to 1).

Conclusions: No evidence was identified to estimate the effect of adding tDCS to walking training on gait freezing, falls and social participation.

Funding: Fundação de Amparo à Pesquisa e Inovação do Espírito Santo – FAPES (Universal - 021/2018), Brazil.

Conflict of Interest: None

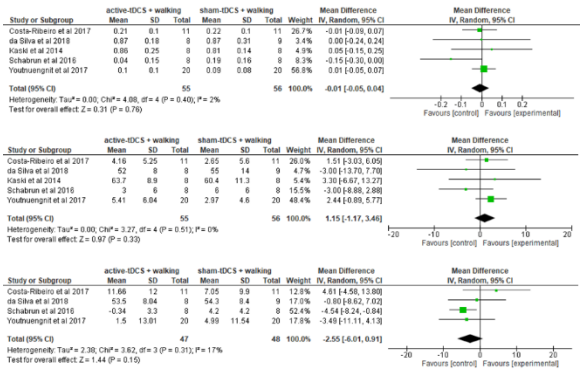

Figure 1. Detailed forest plot of the mean difference (95% CI) in the effect of walking training combined with tDCS versus sham-tDCS + walking training immediately after intervention on (a) walking speed (m/s; n = 111), (b) step length (cm; n = 111) and (c) cadence (steps/minute; n = 95).

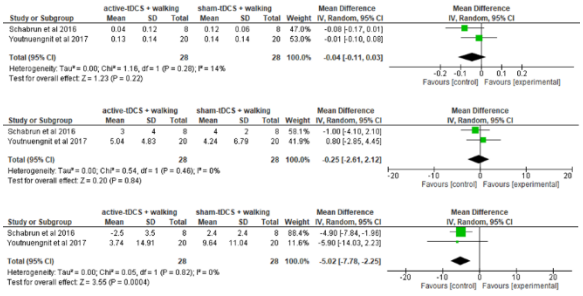

Figure 2. Detailed forest plot of the mean difference (95% CI) in the effect of walking training combined with tDCS versus sham-tDCS + walking training beyond the intervention period on (a) walking speed (m/s; n = 56), (b) step length (cm; n = 56) and (c) cadence (steps/minute; n = 56).

I.4. Immediate effects on functional mobility of patients with knee osteoarthritis after a single session of repetitive transcranial magnetic stimulation and manual therapy

Camilla Santos Araújo[1], *Mannaly Braga de Mendonça*[1], *Gabriel Barreto Antonino*[1], *Rodrigo de Mattos Brito*[1,2], *Carolina Duarte Cavalcanti de Melo*[1], *Raylene Acácia Pires de Araújo Ramalho*[1], *Kátia Monte-Silva*[1,2].

1. Laboratório de Neurociência Aplicada (LANA) – Universidade Federal de Pernambuco, Recife, PE, Brasil;

2. Rede NAPeN (Núcleo de Assistência e Pesquisa em Neuromodulação), Brasil.

Objective: To identify the immediate effects of the association of repetitive transcranial magnetic stimulation (rTMS) with manual therapy (MT) on the functional mobility of individuals with knee osteoarthritis (KOA).

Methods: Thirty-six individuals with KOA (mean age: 64.9±8.01; 29 female) were assessed and treated. The included individuals were randomly divided into three equal groups of 12 patients: rTMS; rTMS-Sham/MT; rTMS/MT. High frequency rTMS (10Hz; 90% of motor threshold; 1200 pulses) was applied over the primary motor cortex contralateral to the most affected knee. MT carried out with osteopathy techniques and knee massage immediately after rTMS (active or sham). The functional mobility of individuals with KOA was assessed before and after a single session of interventions through the timed up and go test (TUG test). The number of individuals who reached a reduction of 1.14 seconds in the TUG test (minimal clinically important difference - MCID for the KO population) was considered for statistical analysis.

Results: No difference between the groups regarding clinical and demographic characteristics was found ($p \geq 0.05$). After the session, 75%, 67% and 50% of the individuals from the groups rTMS, rTMS-Sham/MT, and rTMS/MT, respectively, reached the MCID in the TUG test, however there was no difference between the groups ($p \geq 0.05$).

Conclusions: A single rTMS or MT session increases functional mobility in at least half of treated individuals with KOA. The combination of the techniques do not seem to benefit the immediate effects of isolated interventions.

Funding: None

Conflict of Interest: None

I.5. Individuals with serious traumatic brain injury in the sub-acute phase would benefit from transcranial direct current stimulation (tDCS)?

Bárbara Naeme de Lima Cordeiro[1], *Elizângela Kuster*[2], *Fernando Zanela da Silva Areas*[2].

1.Laboratório de Neurorreabilitação e Neuromodulação, Universidade Federal do Espírito Santo, Departamento de Ciências Fisiológicas, Vitória, ES, Brasil;

2.Universidade Federal do Espírito Santo, Departamento de Educação integrada em Saúde, Vitória, ES, Brasil.

Objective: Based on current evidence, we hypothesized that performing tDCS sessions in individuals with TBI, especially in the acute phase, in conjunction with conventional therapy sessions, could improve cognition and motor function in this population.

Methods: Traumatic Brain Injury (TBI) is a major cause of disability and mortality in young adults. Current scientific evidence shows that motor

dysfunction and cognitive impairment are the main limiting factors in TBI patients. Transcranial direct current stimulation (tDCS) seems to be a viable option. Studies have shown that tDCS regulates brain function through activation of the cerebral cortex through the use of electrical current and, therefore, can induce bidirectional changes in motor cortical excitability, depending on polarity. In addition, one study reported that tDCS increases cerebral blood volume and flow, suggesting better oxygen delivery to brain tissue. However, when it comes to patients with TBI, the results are inconclusive, especially in the acute phase, and some protocols have not yet been tested.
Results: We believe that these results are relevant to the field of Medicine and Rehabilitation.
Conclusions: In conclusion, the results may provide a new therapeutic strategy for early rehabilitation with neuromodulation in patients with acute TBI, seeking to elucidate the extent to which early tDCS can impact short- and long-term clinical outcomes.
Funding: None
Conflict of Interest: None

I.6. The influence of Transcranial Magnetic Stimulation associated with physical therapy on the balance of people with Multiple Sclerosis

Alice Estevo Dias[1], Juliana Aparecida Rhein Telles[1], Andre Virgílio dos Santos Caetano Vitor[2], Maria Eduarda Tessitore[2], Vitor Duque[2], Luiz Henrique Quiquetto Martins[2], Francielly Ferreira Santos[3], Carlos Bandeira de Mello Monteiro[2], ***Talita Dias da Silva[2].***
1.Associação Brasileira de Esclerose Múltipla (ABEM);
2.Grupo de Pesquisa e Aplicação Tecnológica em Reabilitação da Universidade de São Paulo (PATER/USP);
3.Departamento de Neuromodulação do Instituto Central do Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo (ICHCFMUSP).

Objective: To evaluate the influence of Transcranial Magnetic Stimulation combined with physical therapy on the balance of people with Multiple Sclerosis.
Methods: 10 people with Multiple Sclerosis(MS) participated, 7 women and 3 men, aged 40 to 57 years and Kurtze Expanded Disability Status Scale (EDSS) between 1 and 5.5. The protocol consisted of 10 Tanscranial Magnetic Stimulation (TMS) sessions and 6 physiotherapy sessions with a protocol for lower limb strength training and static and dynamic balance. Participants were randomized and divided into 2 groups: Group I) with real stimulus, so that 5 received the TMS stimulus (primary motor cortex (Cz): 50 pulses per time, 30 trains, 20seconds of interval, totaling 1500 pulses at 90% of resting motor threshold and left dorsolateral prefrontal cortex (F3): 10Hz, 50 pulses per train, 40 trains, 20 seconds interval, totaling 2000 pulses at 110% of resting threshold), and Group II) sham, so that received the application without TMS stimulation. All underwent physiotherapy. The Berg Balance Scale was applied before the combined interventions and after 30 days.
Results: It was found that 90% of participants showed improvement in balance. Only one participant showed a worsening in this index.
Conclusions: This preliminary study suggests that TMS associated with physiotherapy has great potential in the rehabilitation of balance in people with MS. The promising results encourage the acquisition of additional evidence.
Funding: None
Conflict of Interest: None
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I.7. Motor performance during transcranial direct current stimulation (tDCS) associated with virtual game in children and adolescents with Cerebral Palsy

Camila Aparecida de Oliveira Alberissi[1], Anne Michelli Gomes Gonçalves Fontes[2], Barbara Soares de Oliveira-Furlan[1], Tatiane Tedeschi Roque[1], Marina Junqueira Airoldi[1], Ibis Ariana Peña de Moraes[2], ***Amanda Vitale da Costa[3]****, Felipe Fregni[4], Helen Dawes[5], Carlos Bandeira de Mello Monteiro[1,2], Talita Dias da Silva[1,2,3].*
1.Grupo de Pesquisa e Aplicações Tecnológicas em Reabilitação (PATER), Escola de Artes, Ciências e Humanidades, Universidade de São Paulo (EACH-USP), São Paulo, Brazil;
2.Programa de Pós-Graduação em Ciências da Reabilitação, Faculdade de Medicina da Universidade de São Paulo (FMUSP), São Paulo, Brazil;
3.Faculdade de Medicina, Universidade Cidade de São Paulo (UNICID), São Paulo, Brazil;

4.Neuromodulation Center and Center for Clinical Research Learning, Spaulding Rehabilitation Hospital and Massachusetts General Hospital, Boston, Massachusetts;
5.Institute of Nursing and Allied Health Research, Oxford Brookes University, Oxford, UK.

Objective: Verify the motor performance of children and adolescents with cerebral palsy during the performance of a single session of transcranial direct current stimulation combined with a virtual reality task.
Methods: A cross-sectional, randomized, sham-controlled, triple-blind clinical trial was performed. Thirty-six individuals with gross motor function of levels I to V (aged 3-19 years old) were recruited. Individuals were randomly assigned to Group 1 (PC, active tDCS + VR) or Group 2 (PC, sham tDCS + VR). For the active tDCS the protocol used low frequency tDCS [intensity of 1 milliampere (mA)] over the primary cortex (M1) area on the dominant side of the brain. We assessed coincident timing through MoveHero VR Software and characterization assessments Gross Motor Function Classification System (GMFCS). Multiple Analysis of Variance (MANOVA) was used to compare Groups (active x sham), Functional level (Mild I-III x Severe IV-V) and its interactions for right and left upper limbs.
Results: Absolute error was measured in milliseconds and considerate as dependent variable, given by the virtual game. No significant effect or interaction was found for Group or Functional level.
Conclusions: There were no significant difference between active and sham tDCS in a single session protocol associated with virtual reality regarding accuracy of movement, as well as there was no effect of Functional level.
Keywords: Cerebral palsy, Virtual Reality, Transcranial Direct Current Stimulation, Motor activity, Psychomotor Performance.
Funding: None
Conflict of Interest: None

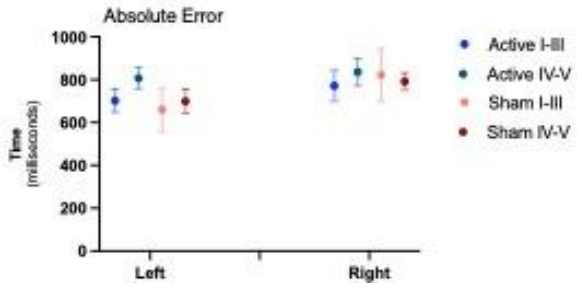

Figure 1: Representation of Absolute Error for Active and Sham groups and the functional level subgroups (Mild - GMFCS I to III; Severe - GMFCS IV and V).

I.8. Effect on Trunk Control in People with Spinal Cord Injury through Transcranial Direct Current Stimulation (tDCS) associated with Virtual Reality (VR)

*Nadja Moreira da Silva[1,2], Fernanda Rocha Corrêa[1], Giovanna de Paula Vidigal[1,4], Lilian Del Ciello de Menezes[1,2], Natalia Padula[1], Mariana Rocco Barros[3], **Anna Lydia Machado da Silva[3]**, Carlos Bandeira de Mello Monteiro[1,4], Talita Dias da Silva[1,2,3];*
1.Grupo de Pesquisa e Aplicações Tecnológicas em Reabilitação (PATER), Escola de Artes, Ciências e Humanidades, Universidade de São Paulo (EACH-USP), São Paulo, Brazil;
2.Programa de Pós Graduação em Cardiologia da Escola Paulista de Medicina da Universidade Federal de São Paulo (UNIFESP), São Paulo, Brazil;
3.Faculdade de Medicina, Universidade Cidade de São Paulo (UNICID), São Paulo, Brazil;
4.Programa de Pós-Graduação em Ciências da Reabilitação, Faculdade de Medicina da Universidade de São Paulo (FMUSP), São Paulo, Brazil.

Objective: To assess the effect of transcranial direct current stimulation (tDCS) combined with virtual reality (VR) to evaluate the potential influence on trunk control in people with Spinal Cord Injury.
Methods: The individuals aged between 21 to 57 years old, of both genders were randomly and double-blind assigned in two Groups tDCS active and tDCS sham. Initially, assessments on multidirectional trunk balance were performed. Then, they participated on protocol: rest for 10 minutes, followed by 10 minutes of VR training - during the 20 minutes they were stimulated with anode and bilateral current over the primary motor cortex (3mA, 1,5 mA in each target). The sessions were performed for the following two weeks (10 sessions), with assessments and reassessments.
Results: 18 subjects (11 sham and 9 active) were analysed and both groups showed improvement in trunk control (p= 0.048), static (p=0.012) and dynamic balance with upper limbs activity (p= 0.010) after 5 and 10 days, without significant changes between sham and active.
Conclusions: The therapy with games in VR improved trunk control in patients with Spinal Cord Injury, without significant changes when combined with tDCS.
Keywords: Transcranial Direct Current Stimulation, Virtual Reality, Psychomotor Performance, Trunk Control, Spinal Cord Injuries;
Funding: None
Conflict of Interest: None

I.9. Transcranial stimulation by continuous current in the performance of the vertical jump in soccer players

Jader Vinicius da Silva Rocha[1], *Bárbara NLC[1], Carlos HCS[1], Ricardo R, Rodrigo FA[1], Fernando ZA[1]. 1.Laboratory of Neurorehabilitation and Neuromodulation, Departament of Physiological Sciences, Federal University of Espirito Santo, Department of Physiological Sciences, Vitória, ES, Brazil.*

Objective: The aim of this study was to investigate whether tDCS on the motor cortex (M1) results in improved performance and subjective responses when compared to the sham and control group in soccer players.

Methods: This is a double-blind, randomized study, in which 9 players were randomized into three groups: active tDCS group (n=3); Sham Group (n=3) and Control Group (n=3). The study was carried out with professional players in the under 20 category. The study was carried out during 3 sessions, with a constant current of intensity of 2mA for 15 minutes.

Results: The results showed that TDCS improves performance sharply (height and flight time) ($p<0.05$). However, there was no statistical significance for SPE ($p>0.05$).

Conclusions: In conclusion, the results show that tDCS on M1 improves players performance, however it did not improve SPE.

Funding: Capes

Conflict of Interest: None

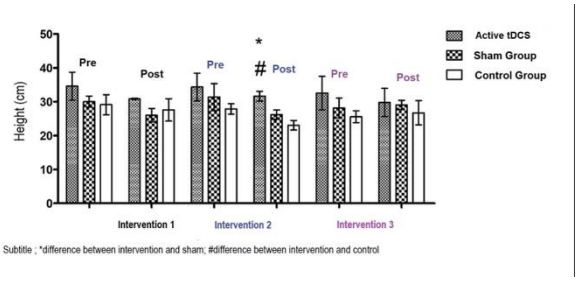

Figure 1.

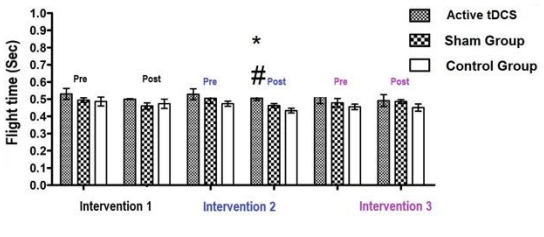

Figure 2.

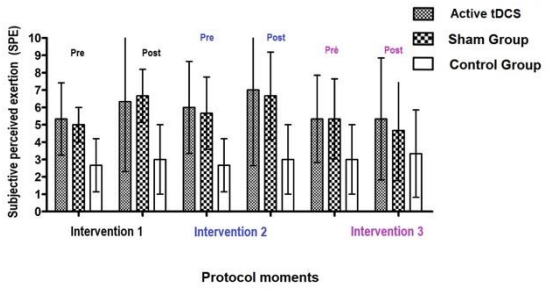

Figure 3.

I.10. Motor performance during transcranial direct current stimulation (tDCS) associated with virtual game in children and adolescents with Cerebral Palsy (CP)

Talita Dias da Silva[1,2,3], Anne Michelli Gomes Gonçalves Fontes[2], Camila Aparecida de Oliveira Alberissi[1], Barbara Soares de Oliveira-Furlan[1], Tatiane Tedeschi Roque1, Marina Junqueira Airoldi[1], Ibis Ariana Peña de Moraes[2], Isabelle Imperatrice Melhado[3], Felipe Fregni4, Helen Dawes[5], Carlos Bandeira de Mello Monteiro[1,2].

1Grupo de Pesquisa e Aplicações Tecnológicas em Reabilitação (PATER), Escola de Artes, Ciências e Humanidades, Universidade de São Paulo (EACH-USP), São Paulo, Brazil; 2Programa de Pós-Graduação em Ciências da Reabilitação, Faculdade de Medicina da Universidade de São Paulo (FMUSP), São Paulo, Brazil; 3 Faculdade de Medicina, Universidade Cidade de São Paulo (UNICID), São Paulo, Brazil; 4 Neuromodulation Center and Center for Clinical Research Learning, Spaulding Rehabilitation Hospital and Massachusetts General Hospital, Boston, Massachusetts; 5 Institute of Nursing and Allied Health Research, Oxford Brookes University, Oxford, UK.

Objective: To assess the ability of movement anticipation in upper limbs of individuals with cerebral palsy after 10 sessions of tDCS associated with virtual game.

Methods: A randomized, sham-controlled, triple-blind clinical trial was performed. Thirty-six individuals with gross motor function of levels I to V (aged 3-19 years old) were recruited and randomly assigned to Group active or Group sham. We used intensity of 1 milliampere over the primary cortex area on the dominant side of the brain. We assessed coincident timing through a task in a virtual environment. They performed 20 attempts (acquisition), 5 for retention and transfer tests, and for the day after 1 and 10 sessions. All attempts were divided in blocks of five attempts each. Multiple Analysis of Variance (MANOVA) was used to compare effects and interactions for Group (active x

sham) and Performance (Best x Worst), with repeated measures for blocks of attempts.
Results: Both active and sham groups with worse performance at the beginning significantly improved performance (p=0.018), retained and transferred performance before interventions, with no difference between groups. A marginally significant difference between groups (p=0.018) was found after one session, which did not last until the 10th session.
Conclusions: The session with tDCS seems to increase the speed of learning, but after 10 sessions of tDCS and VR, active and sham groups presented similar performance.
Keywords: Cerebral Palsy, Virtual Reality, Transcranial Stimulation Therapy, Motor Activity, Psychomotor Performance.
Funding: None
Conflict of Interest: None

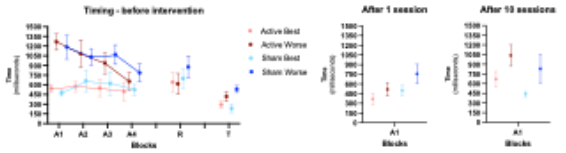

Figure 1: Representation of Absolute Error for Active and Sham groups and with Better and worst performance at the begining of the trial.

II. Pain

II.1. Alpha-2 oscillations as a predictor of tDCS response in women with fibromyalgia.

Marcela Laís Lima Holmes Madruga[1], *Géssika Araújo de Melo[2], Suellen Mary Marinho dos Santos Andrade[1].*
1.Neuroscience and Aging Lab, Federal University of Paraiba, Brazil;
2.Cognitive Science and Perception Lab, Federal University of Paraiba, Brazil.

Objective: Thus, we aim to investigate the alpha-2 prediction potential for clinically significant response to transcranial direct current stimulation (tDCS).
Methods: 31 participants, aged between 27 and 58 years, diagnosed with FM for at least three months were submitted to tDCS in M1, the current intensity was 2mA during 20 minutes. After the intervention protocol, they were divided into two groups, responders (R) and non-responders (NR), based on the minimum clinically significant response of 15% difference in the Visual Analog Scale. Alpha-2 mean spectral power were analyzed in the frontal, parietal and occipital regions.
Results: There were no statistical differences between alpha2 means in the frontal (t=-0.19,p=0.84), parietal (t=1.05,p=0.30) and occipital (t=1, 08,p=0.28) areas between the two groups. In addition, alpha2 frontal (B=0.04, p=0.78), alpha2 parietal (B=-0.12,p=0.33) and alpha2 occipital (B=-0.27, p=0.82) did not show minimal contributions when observed in a linear regression model to predict pain improvement after tDCS.
Conclusions: The nonlinear neural processes involved in tDCS modulation may not be affected by the electroencephalographic activity related to the alpha-2 band in FM. However, it is crucial to analyze clinical predictive factors and its relationship with EEG activity patterns.
Funding: None
Conflict of Interest: None

II.2. Immediate and late effects of a single session of repetitive transcranial magnetic stimulation and manual therapy over pain in patients with knee osteoarthritis

Carolina Duarte Cavalcanti de Melo[1], *Mannaly Braga de Mendonça[1], Gabriel Barreto Antonino[1], Rodrigo de Mattos Brito[1,2], Camilla Santos Araújo[1], Raylene Acácia Pires de Araújo Ramalho[1], Kátia Monte-Silva[1,2].*
1.Laboratory of Applied Neuroscience, Universidade Federal de Pernambuco, Recife, PE, Brazil;
2.NAPeN Network (Núcleo de Assistência e Pesquisa em Neuromodulação), Brazil.

Objective: To analyze the effects of repetitive transcranial magnetic stimulation (rTMS) associated with manual therapy (MT) on pain in individuals with knee osteoarthritis (KOA).
Methods: In a double-blind, randomized, and controlled trial, individuals with KOA (n=36; 64.9±8.01 years; 29 women) were divided into three groups: rTMS (n=12); rTMS-sham/MT (n=12) or rTMS/MT (n=12). rTMS (10Hz; 90% of motor threshold; 1200 pulses) was applied over the primary motor cortex contralateral to the affected knee. MT was performed with osteopathy and massage on the knee region immediately after rTMS (active or sham). Each group underwent a single intervention session. Pain intensity was assessed with Visual Analog Scale (VAS) before, immediately after (T1) and at 5, 15 and 30 days after the intervention. For the analysis, the number of individuals responsive to the intervention (>30% reduction of VAS) was considered.
Results: The clinical and demographic characteristics of individuals did not differ between groups (p>0.05). At T1, 84%, 34% and 59% of the individuals responded to the intervention in the groups rTMS; rTMS-sham/MT and rTMS/MT, respectively (p=0,016). Of these, 67% (rTMS), 45% (rTMS-sham/MT) and 50% (rTMS/MT) maintained the

effects after 30 days (p=0,46). There was a significant difference only in the T1 moment for rTMS.
Conclusions: rTMS appears to promote better therapeutic effects over pain perception in subjects with KOA.
Keywords: Knee osteoarthritis; Pain; Repetitive transcranial magnetic stimulation; Manual therapy;
Funding: None
Conflict of Interest: None

II.3. rTMS reverses thermal hyperalgesia and long-term memory impairment in rats submitted to a neuropathic pain model

Roberta Ströher Toledo*[1,2]*,Dirson João Stein*[2,3]*, Paulo Roberto Stefani Sanches*[4]*,Lisiane Santos da Silva*[2,3]*, Helouise Richardt Medeiros*[2,3]*, Felipe Fregni*[5]*, Wolnei Caumo*[3]*, Iraci LS Torres*[1,2,3]*.
1. Programa de Pós-Graduação em Ciências Biológicas: Farmacologia e Terapêutica – Instituto de Ciências Básicas da Saúde - Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, RS, Brazil;
2. Laboratório de Farmacologia da Dor e Neuromodulação: Investigações Pré-clínicas – Hospital de Clínicas de Porto Alegre, Porto Alegre, RS, Brazil;
3. Programa de Pós-Graduação em Medicina: Ciências Médicas - Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil;
4. Serviço de Pesquisa e Desenvolvimento em Engenharia Biomédica, Hospital de Clínicas de Porto Alegre, Porto Alegre, RS, Brazil;
5. Laboratory of Neuromodulation, Department of Physical Medicine & Rehabilitation, Spaulding Rehabilitation Hospital and Massachusetts General Hospital, Harvard University, Boston, MA, USA.

Objective: To evaluate the effects of repetitive transcranial magnetic stimulation (rTMS) on nociception and long-term memory in rats submitted to a neuropathic pain (NP) model.
Methods: 63 male Wistar rats (±60 days) were initially divided into 3 groups for pain model induction: Control (without manipulation), Sham DN (nerve exposure only) and NP (sciatic nerve constriction surgery), further subdivided into: no treatment, Sham rTMS and rTMS, resulting in 9 groups. Treatment with rTMS consisted of 1 session of 5 min/day/8 consecutive days. For Sham rTMS treatment, the magnetic generator remained off. The evaluation of thermal hyperalgesia was performed using the hot plate test at baseline, 14 days after surgery and 24 hours after the last rTMS session. The object recognition test (ORT) was used to assess long-term memory. Data were analyzed by GEE/Bonferroni (hot plate) and one-way ANOVA/SNK (ORT), considering $P<0.05$. Project approved by CEUA/HCPA #2017-0438.
Results: NP animals treated with rTMS showed reversal of thermal hyperalgesia (GEE, Wald $\chi2=75.26$, $P<0.05$) and long-term memory impairment (one-way ANOVA, $F8.62=2.27$, $P<0.05$), both induced by the NP model.
Conclusions: The beneficial effects of rTMS reversing impairments in nociception and memory induced by NP may be related to stimulation-induced changes in IL-10 and BDNF levels in prefrontal cortex and hippocampus, already observed in our previous study, suggesting modulation of the neuroplasticity process.
Funding: National Council for Scientific and Technological Development–CNPq / Brazilian Committee for the Development of Higher Education Personnel – CAPES / CAPES/PNPD Edital PPGCM 07/2016 / Research Support Foundation of the State of Rio Grande do Sul.
Conflict of Interest: None

II.4. Transcranial Direct Current Stimulation alters anxious-like behavior and neural parameters in rats with chronic pain exposed to alcohol

Dirson João Stein*[1,2]*, Daniela Silva Santos*[1,2]*, Helouise Richardt Medeiros*[1,2]*, Fernanda dos Santos Pereira*[1]*, Isabel Cristina de Macedo*[1,4]*, Felipe Fregni*[3]*, Wolnei Caumo*[2]*, Iraci L. S. Torres*[1,2]*.
1.Laboratory of Pain Pharmacology and Neuromodulation: Preclinical Investigations, Center of Experimental Research, Hospital de Clínicas de Porto Alegre, Porto Alegre, RS, Brazil;
2. Postgraduate Program in Medical Sciences, School of Medicine, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil;
3. Laboratory of Neuromodulation, Department of Physical Medicine & Rehabilitation, Spaulding Rehabilitation Hospital and Massachusetts General Hospital, Harvard University, Boston, MA, USA;
4. Faculdade de Medicina. Universidade Federal do Pampa, Uruguaiana, RS, Brazil.

Objective: To evaluate the effects of transcranial direct current stimulation (tDCS) on anxiety-like behavior and neural parameters in rats with chronic pain exposed to alcohol.
Methods: 36 adult male Wistar rats were randomly assigned to control (CT), neuropathic pain (NP), NPtDCS, NP+alcohol (NPAL), or NPALtDCS groups, subjected to sciatic nerve chronic constriction injury (CCI) and exposed to alcohol or vehicle (gavage, 15 days). Rats were treated using bimodal tDCS (0.5 mA/20 min/8 days), tested in the open field and killed 24 hours after the last behavioral assessment. Brain and spinal cord tissue samples were

collected and processed for NPY immunohistochemistry, expression of Il1a and Il1b in the spinal cord, cerebellum, and hippocampus, and levels of IL-1α and IL-1β in the same brain structures and the striatum. Data were analyzed by GEE/Bonferroni (behavior), % change from control (NPY) and one-way ANOVA/SNK (Ils), considering $P<0.05$. Project approved by CEUA/HCPA #2015-0501.

Results: tDCS reverted the anxiety-like behavior induced by CCI and alcohol, and the increased expression of Il1a in the spinal cord induced by alcohol, which also increased the expression of Il1b in the cerebellum. In addition, tDCS modulated the hypothalamic NPY-immunoreactivity, increased the levels of IL-1α in the hippocampus (like NP and AL), and increased the expression of Il1b in the spinal cord (like AL).

Conclusions: tDCS changes NP and alcohol-induced anxiety-like behavior, possibly through its central modulatory effects of NPY and spinal cord expression of Il1a and Il1b, being a potential treatment option for alcohol and NP-induced anxiety symptoms.

Funding: Brazilian Federal Agency for Support and Evaluation of Graduate Education - CAPES/MD-PhD (DS Santos); PNPD-CAPES; National Council for Scientific and Technological Development-CNPq; Graduate Research Group of the Hospital de Clínicas de Porto Alegre – FIPE-GPPG.

Conflict of Interest: None

II.5. Effects of transcranial direct current stimulation associated with manual therapy on the vagus nerve in women with fibromyalgia: a pilot study

Aebe Alves Torres, *Pedro Henrique Cassaro Lirio[1,2], Barbara Naeme Lima Cordeiro[1,2], Andressa Braz Carlini Pestana[1,2], Fernando Zanela da Silva Arêas[1,2].*
1.Laboratory of Neurorehabilitation and Neuromodulation - Departament of Physiological Sciences, Federal University of Espirito Santo, Vitória, ES, Brazil;
2.Laboratório de Neurorreabilitação e Neuromodulação - Departamento de Ciências Fisiológicas, Universidade Federal do Espirito Santo, Vitória, ES, Brasil.

Objective: To assess the effect of manual therapy on the Vagus nerve (MTVN) associated with transcranial direct current stimulation (tDCS) on pain in women with fibromyalgia (FM).

Methods: This is a clinical trial, randomized, controlled and with analysis by intention to treat, in which 13 women with FM were allocated to the intervention groups (active tDCS + active MTVN) or control (active tDCS + MTVN SHAM). Five interventions were carried out on consecutive days. Initially, tDCS was applied and then MTVN. Pain was assessed using a visual analogue scale (VAS) before and after the first intervention and after 5 interventions. To assemble the tDCS, the anodic electrode was placed in the left primary motor cortex and the cathode in the right supraorbital region, at an intensity of 2mA, for 20 minutes. For MTVN, myofascial maneuvers were performed on the path from the cranium vagus to the abdomen. For MTVN SHAM, hand positioning was held as in the active protocol, however no movement was performed.

Results: By the VAS - pain scale, a significance of 0.026 was found in the reduction of pain in the intervention group, compared to the SHAM group after the fifth session, confirmed by Bonferroni post hoc ($p=0.009$).

Conclusions: MTVN associated with tDCS enhances pain relief in women with FM.

Funding: None

Conflict of Interest: None

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II.6. Transcranial direct-current stimulation on pain control in patients with rheumatoid arthritis: a study protocol of a randomized, placebo-controlled, double-blind, phase ii clinical trial

Pablo Costa Cortez[1], *Roberta Lins Gonçalves[1], Antônio Luiz Ribeiro Boechat Lopes[1].*
1.Federal University of Amazonas (UFAM).

Objective: The primary aim of this study is to evaluate the efficacy of Transcranial Direct-Current Stimulation (tDCS) in reducing the level of chronic pain in individuals with Rheumatoid Arthritis (RA). Secondary aims include assessing the efficacy of tDCS in outcomes related to the level of pain during the ten consecutive sessions, inflammatory activity, quality of life (QoL), functional status, and Cardiac Autonomic Behavior (CAB).

Methods: This study is a placebo-controlled, double-blinded, superior, phase II, randomized clinical trial (1:1). The study will take place at the Pain and

Neuromodulation Laboratory in the Federal University of Amazonas. The sample size was estimated at 53 participants, assuming a dropout rate of 20%, 80% power, and 5% alpha. The participants will be recruited in partnership with Foundation Adriano Jorge Hospital, Adventista Hospital, and private clinics. The mixed ANOVA model will be used for statistical analysis. Post-hoc comparisons will be performed using Bonferroni's correction. For non-parametric data, the Friedman Two-Way ANOVA test and the Conover-Iman test for posthoc comparisons will be applied.

Results: It is expected that tDCS combined with standard pharmacological treatment for chronic pain is superior when compared to isolated treatment, reducing the level of pain in individuals with RA and improving secondary aspects such as inflammatory disease activity, QoL, functional status, and CAB.

Conclusions: Successful completion of the objectives of this study will provide evidence for the development of new cost-effective treatment approaches for reducing chronic pain levels in RA patients.

Funding: None

Conflict of Interest: None

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III. Cognition

III.1. Effects of transcranial direct current stimulation in individuals with serious traumatic injury in the sub-acute phase: study protocol

*Bárbara Naeme de Lima Cordeiro[1], **Elizangela Kuster[2]**, Aurore Thibaut[3], Lucas Rodrigues Nascimento[2,4], Guilherme Tinoco Areas[5], Wellingson Silva Paiva[6], Fernando Zanela Areas[1,2].*

1.Laboratory of Cognitive and Neuropsychopharmacological Sciences, Federal University of Espírito Santo, Department of Physiologial Sciences, Vitória, ES, Brazil;

2.Federal University of Espírito Santo, Department of Integrated Health Education, Vitória, ES, Brazil;

3.Coma Science Group, GIGA Consciousness, University of Liège, Liège, Belgium;

4. NeuroGroup, Discipline of Physiotherapy, Federal University of Minas Gerais, Belo Horizonte, Brazil;

5.Department of Physiological Sciences, Federal University of Amazonas, Manaus. AM, Brazil;

6.Division of Neurosurgery, Hospital das Clínicas HCFMUSP, São Paulo. SP, Brazil.

Objective: The aim of the study will be to examine the immediate and late effects of tDCS on cognitive function, pain, functional independence, anxiety and depression, hospital complications and length of stay in individuals with severe TBI in the subacute phase.

Methods: This will be a randomized, two-arm, prospectively registered study with hidden allocation, blinded evaluators, participants and therapists, and intention-to-treat analysis. The study will consist of 30 individuals with severe TBI, who were discharged from the intensive care unit for at least two weeks. Participants will be randomly assigned to an experimental group (tDCS 2mA active for 20 minutes) or a control group (TCS sham for 20 minutes). Participants will receive ETCC sessions 5 times a week for 4 weeks, totaling 20 sessions.

Results: Outcome measures will be collected by trained investigators at baseline (week 0), after 20 tDCS sessions (week 4), 6 months and one year after treatment, both over the phone.

Conclusions: The results of this clinical trial may provide a new therapeutic strategy for early rehabilitation with neuromodulation in patients with acute TBI.

Funding: None

Conflict of Interest: None

III.2. The use of Transcranial Direct Current Stimulation and Mindfulness as an intervention for ADHD patients

***Renata Alessandra Pereira*[1]*; Viviane Freire Bueno*[1]*; Camila Campanhã*[1,2].**

1. ASCAN Lab, Curso de Psicologia da Universidade Cruzeiro do Sul, São Paulo - SP;

2. Universidade Presbiteriana Mackenzie- São Paulo.

Objective: This project aimed to verify the concomitant use of Transcranial Direct Current Stimulation (TDCS) and audio Mindfulness training as an intervention strategy to reduce ADHD symptoms in a manner equivalent to pharmacological treatment in adults patients who cannot use medication. Sought to investigate the effects of this intervention on the executive functions of adults diagnosed with ADHD, comparing the effects between pre and post treatment, as well the group using ADHD medication (control group).

Methods: A pilot study was conducted with a sample of 32 subjects (mean age 29.34 years and SD 5.47), being 21 (65.6%) females and 11 (34.3%) males by experimental method with control group. Of this sample, 34.37%(11) had a complete undergraduate degree; 21.87%(7) had an incomplete undergraduate degree; 34.37%(11) had a postgraduate degree; and 6.25%(2) had a complete high school education and 3.12%(1) had an incomplete high school education. Fifteen subjects were part of the experimental group (53.33% female and 46.66% male). The control group was composed of 17 subjects (76.47% female, mean age 28.53 and SD 4.70; and 23.52% male, mean age 32.25 and SD 8.53) who were undergoing pharmacological treatment for ADHD. The experimental group had 10 consecutive sessions of Neuroconn anodic TDCS in left DLPFC and cathodic in supraorbital (2mA, 35cm2 electrodes) for 20 min concomitant with Mindfulness practice by audio. Executive function tests, ADHD symptoms scales and Mindfulness skills scales were applied.

Results: Higher accuracy was observed in the post intervention group than in the medication group ($p<0.001$; mean post= 10.87 ±1.807; mean medication= 6.59 ±4.02) in the No-Go condition on the Go/No Go task. In the Stroop test, the intervention group obtained lower interference scores in post intervention compared to pre intervention ($p\leq 0.046$; mean pre= -1.0 ±2.07; mean post=0.31 ±0.25). No significant effects were observed on the BART task and the N-Back. In the ASRS-18 scale, there was a reduction in the Total score after intervention compared to pre ($p\leq 0.014$; mean pre= 53.40 ±10.8; mean post= 45.33 ±9.42) and compared to the medication group ($p\leq 0.028$; mean post= 45.33 ±9.42; mean medication= 54.12 ±10.94). In the Inattention sub-item there was improvement after intervention ($p\leq 0.018$; mean pre= 30.53 ±5.29; mean post= 25.13 ±5.50) and in relation to the medication group ($p\leq$ 0,015 post= 25.13 ±5.50; mean medication= 29.94 ±5.69). In the MAAS scale there was a significant difference between the post intervention and pre ($p\leq 0.033$; pre mean= 40.33 ±11.95; post mean= 48.20 ±10.93) and between post intervention group and medication group ($p<0.001$; post mean= 48.20 ±10.93; medication mean= 34.71 ±10.04). On the FFMQ scale, the post intervention group showed greater ability to act with awareness ($p\leq 0.049$; mean pre= 5.47 ±2.64; mean post= 7.40 ±2.55) and greater awareness at every moment and/or situation ($p\leq 0.004$; mean pre= 10.80 ±5.75; mean post= 15.60 ±3.85). In the Acting with Awareness sub-item it was significant in the post intervention group compared to the medication group ($p\leq 0.002$; mean post= 7.40 ±2.55; mean medication= 4.65 ±2.34), as in the negative formulation sub-item ($p\leq 0.020$; mean post= 10.53 ±2.97; mean medication= 7.65 ±3.57).

Conclusions: The results suggest an improvement in the inhibitory control, attention, ADHD symptoms, and in Mindfulness skills in post-intervention. Also, an improvement in the inhibitory control, ADHD symptoms and Mindfulness skills was observed in the intervention group related the pharmacological treatment group. Interestingly, the reduction in ADHD symptoms, inhibitory control in the intervention group (TDCS + Mindfulness) was greater than that in the pharmacological group. The application of anodic TDCS in the left DLPFC in the present study points to the use of TDCS and concomitant Mindfulness as a possible alternative form of treatment to pharmacological treatment of ADHD symptoms in adults. The combination of cognitive training and facilitation of left DLPFC activity may have contributed to generate greater neuroplasticity and, consequently, improved performance. Future studies with larger samples are needed to confirm the effectiveness of the present intervention proposal, as well as the combination of stimulation in different brain areas to promote improvement in other symptoms, such as hyperactivity, risky decision-making, and attention. Furthermore, it is suggested that future studies increase the intervention time with TDCS and Mindfulness to more than 10 consecutive sessions, as recent depression patient's studies have been showing greater benefits with 20 consecutive sessions of TDCS.

Funding: CNPQ- National Council for Scientific and Technological Development

Conflict of Interest: None

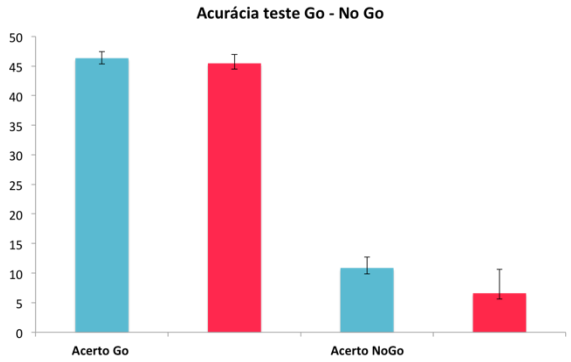

Figure 1. Go-No Go Graphic

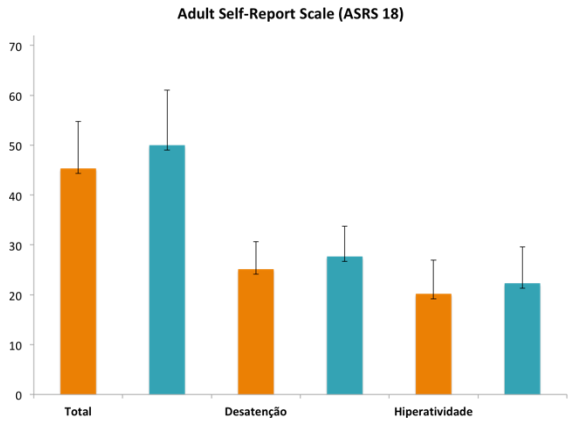

Figure 2.

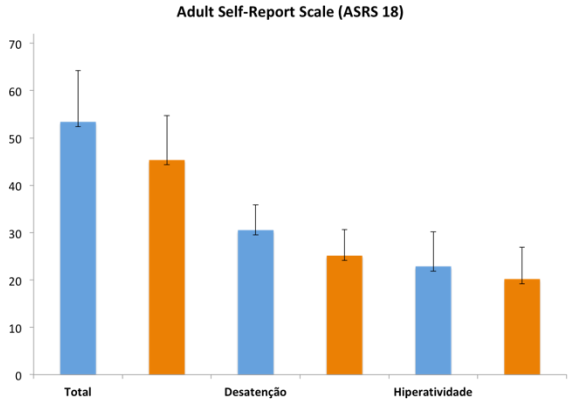

Figure 3.

III.3. tDCS, dlPFC and Borderline Personality Disorder: What do we know so far?

Luna Vasconcelos Felippe[1], *Eduardo Sales Loureiro*[1], *Aldren Thomazini Falçoni Junior*[1], *Raquel Matiello Alves*[1], *Mariana Zamprogno Zottele1 e Ester Miyuki Nakamura-Palacios*[1].

1.Laboratory of Cognitive Sciences and Neuropsychopharmacology of the Federal University of Espírito Santo - Vitória – ES.

Objective: Compare tDCS montages used in studies about borderline personality disorder (BPD).

Methods: This study is a systematic review. Descriptors used on PubMed ("tDCS" [Mesh] AND (borderline personality disorder [MeSH Terms]) led to 5 studies, of which 4 were related to the topic and 3 were included.

Results: Lisoni 2019, applied active-tDCS (2mA; 35mm2 electrode) in daily sessions over 3 weeks (15 sessions). Anodal stimulation was over the right dlPFC (F4), cathodal over the left dlPFC (F3). This montage showed positive results on modulation of impulsivity. Schultze 2019 evaluated if anodal stimulation (1mA; 35mm2 electrode) over the right dlPFC (F4) versus extra cephalic cathodal stimulation could improve cognitive control in BPD patients. This montage showed negative results. In Molavi 2020, the focus was to assess and modulate executive skills, emotion regulation and emotional processing of BPD patients. The montage of choice for stimulation (2mA; 30 mm2 electrode) was anodal electrode over the left DLPFC (F3) and cathodal electrode over the right dlPFC (F4), once a day over 10 consecutive days. This montage showed positive results.

Conclusions: Up to now, it seems that anodal stimulation over the right dlPFC and cathodal over the left dlPFC could be favorable to manage part of the dysexecutive function in BPD, but it must be considered that these studies are still not enough to indicate the use of the tDCS in this personality disorder.

Funding: None

Conflict of Interest: None

IV. Autonomic Cardiac Modulation

IV. 1. Effect of combined therapy of virtual reality (VR) and transcranial direct current stimulation (tDCS) in children and adolescents with cerebral palsy: analysis of the autonomic nervous system.

Anne Michelli Gomes Gonçalves Fontes[1,2], *Camila Aparecida de Oliveira Alberissi*[1], *Barbara Soares de Oliveira-Furlan*[1], *Tatiane Tedeschi Roque*[1], *Marina Junqueira Airoldi*[1], *Ibis Ariana Peña de Moraes*[2], *Ligia Monari*[3], ***Lucas Angelo***[3], *Felipe Fregni*[4], *Helen Dawes*[5], *Talita Dias da Silva1*[2,3], *Carlos Bandeira de Mello Monteiro*[1,2].

1.Grupo de Pesquisa e Aplicações Tecnológicas em Reabilitação (PATER), Escola de Artes, Ciências e Humanidades, Universidade de São Paulo (EACH-USP), São Paulo, Brazil;

2.Programa de Pós-Graduação em Ciências da Reabilitação, Faculdade de Medicina da Universidade de São Paulo (FMUSP), São Paulo, Brazil;

3.Faculdade de Medicina, Universidade Cidade de São Paulo (UNICID), São Paulo, Brazil;

4.Neuromodulation Center and Center for Clinical Research Learning, Spaulding Rehabilitation Hospital and Massachusetts General Hospital, Boston, Massachusetts;
5.Institute of Nursing and Allied Health Research, Oxford Brookes University, Oxford, UK.

Objective: Verify the effect of virtual reality (VR) training for upper limbs associated with transcranial direct current stimulation (tDCS) on heart rate variability (HRV) in children and adolescents with cerebral palsy.
Methods: Children and adolescents with cerebral palsy (CP) diagnosis were allocated in two groups of active tDCS + VR (n=15) and tDCS + VR (n=12) in a protocol of 20 sessions (anodic, with 1 milliampere on primary motor cortex, in the dominant area) with the use of washout and crossover after 10 sessions. Next it was initiated the tDCS application and the training with virtual reality was performed simultaneously, in which was analyzed the motor performance and the HRV was measured during the intervention for 20 minutes. After, 10 minutes of rest was performed to analyze the recovery. For long term effects, the evaluations were performed before protocol, during and after (follow-up).
Results: 27 participants concluded the protocol and were randomized in two groups according with the sequence. For HRV indexes it was observed the significant effect for the Dias factor (SDNN: p = 0,029; rMSSD: p = 0,001; SD1: p = 0,001), in which there was an increase on the active group and a reduction on the sham group.
Conclusions: The group that took part on the combined therapy of active tDCS + VR presented a significant improvement of HRV./O grupo que realizou terapia combinada de tDCS ativa + RV apresentou melhora significativa da VFC.
Keywords: Cerebral palsy, Virtual reality, Transcranial stimulation therapy, Autonomic nervous system, Motor activity.
Funding: None
Conflict of Interest: None

IV. 2. Effect of combined therapy of virtual reality (VR) and transcranial direct current stimulation (tDCS) on autonomic cardiac modulation in adults with spinal cord injury

***Giovanna de Paula Vidigal*[1,4]**, *Nadja Moreira da Silva[1,2], Fernanda Rocha Corrêa[1]; Lilian Del Ciello de Menezes[1,2]; Roberta Caveiro Gaspar[1]; Nicole Carvalho Braga[3]; Ana Carolina Amâncio da Silva[3]; Talita Dias da Silva[1,2,3]; Carlos Bandeira de Mello Monteiro[1,4].*
1.Grupo de Pesquisa e Aplicações Tecnológicas em Reabilitação (PATER), Escola de Artes, Ciências e Humanidades, Universidade de São Paulo (EACH-USP), São Paulo, Brazil;
2.Programa de Pós Graduação em Cardiologia da Escola Paulista de Medicina da Universidade Federal de São Paulo (UNIFESP), São Paulo, Brazil;
3.Faculdade de Medicina, Universidade Cidade de São Paulo (UNICID), São Paulo, Brazil;
4.Programa de Pós-Graduação em Ciências da Reabilitação, Faculdade de Medicina da Universidade de São Paulo (FMUSP), São Paulo, Brazil.

Objective: To investigate the effect of Transcranial Direct Current Stimulation (TDCS) associated with Virtual Reality (VR) on the regulation of the Autonomic Nervous System (ANS) in adults with Spinal Cord Injury.
Methods: Participants, aged 21 to 57 years, of both sexes, and injury level from C5 to T6 were evaluated using the Heart Rate Variability (HRV) in a protocol that lasted 20 minutes, ie: 10 minutes at rest and 10 minutes in game activity with VR and movement of the upper limbs and trunk. During the entire process, there was the capture of HRV and stimulation with tDCS, which was sham or active (anodic and bilateral, with 3 mA over the primary motor cortex, 1.5 mA in each target). Ten consecutive sessions were held, with one assessment and two reassessments after 5 and 10 days of intervention. The separation of the two groups was carried out in a randomized, double-blind and parallel manner.
Results: 18 subjects were analyzed (9 active group and 9 sham). There was a reduction in parasympathetic autonomic modulation, assessed by the rMSSD index, between the first (28±20), fifth (22±16) and tenth sessions (17±14), with no differences between sham and active groups.
Conclusions: VR therapy seems to stimulate sympathetic modulation, even with damage above the nervous roots of the sympathetic nervous system, which may lead to speculation of greater humoral control of this branch of the ANS.
Keywords: Spinal Cord Injuries; Transcranial Direct Current Stimulation; Virtual reality; Autonomic Nervous System.
Funding: None
Conflict of Interest: None

IV. 3. Potential effects of neuromodulation in the management of systemic blood pressure

Pedro Henrique Cassaro Lirio[1], Jéssica Vaz Gonçalves[1], Fernando Zanela da Silva Arêas[1,2], Elizangela Kuster[1], Rafael Brum dos Reis[1,2], Lenon Corrêa de Souza[3], Wagner Jorge Ribeiro Domingues[3], ***Luíz Henrique e Aquino Serudo[4]****, Guilherme Arêas[4].*

1.Laboratory of Neurorehabilitation and Neuromodulation, Departament of Physiological Sciences, Universidade Federal do Espírito Santo, Vitória, ES, Brazil.
2.Center of Health Sciences, discipline of Physical Therapy, Universidade Federal do Espírito Santo, Vitória, ES, Brazil.
3.Institute of Social Sciences education and Zootecnichs, Universidade Federal do Amazonas, Manaus. AM, Brazil.
4.Department of Physiological Sciences, Universidade Federal do Amazonas, Manaus. AM, Brazil.

Objective: Hypertension (HTN) is the most prevalent chronic disease worldwide, affecting approximately one-third of the adult population. The relationship between brain activity and hypertension has been demonstrated by neurophysiological studies in animals, showing that direct electrical or chemical stimulation of different structures in the brainstem and in the cerebral cortex can significantly modify blood pressure (BP) and heart rate (HR). Given the relationship between blood pressure and cortical activity, brain stimulation techniques, therefore, seem to be a potentially useful tool to be explored. Transcranial direct current stimulation (tDCS) is a non-invasive brain stimulation technique that emerges as an alternative to modulate brain function and treat neural disorders and is currently used in animal experiments to obtain more information about the mechanisms of physiological effects stimulation. Much of the current literary evidence credits the BP regulation mechanism only to the ANS (autonomic nervous system) and to the renin-angiotensin-aldosterone (RAS) system, but there are little explored data that suggest a fundamental role in long-term regulation through stimulation in the CNS, which could lead to a new approach to BP control. Thus, we suggest the hypothesis that the use of tDCS may be able to modulate systemic blood pressure through stimulation in the cerebral cortex.
Methods: The sample will consist of 100 individuals over 30 years of age, of both sexes, firstly separated into two groups (male and female), to then be separated into six groups according to their age group, with group 1 being the age group. age from 30 to 39, group of 2 between 40 to 49, group 3 with ages between 50 to 59, group 4 with elderly people aged between 60 and 69 years, group 5 will be composed of elderly people with the age range of 70 to 79 years old and group 6 above 80 years old, all resident in Manaus. Participants will be instructed on the procedures to be performed and must sign the Informed Consent Form (APPENDIX 1), after approval by the Ethics Committee for Research in Human Beings of the Federal University of Amazonas – UFAM.
The recruitment of volunteers will be carried out by means of a personal invitation in the Manaus community, at events provided by UFAM, by local colleges and at the Family Health Centers. Men and women over 30 years old, who have been diagnosed with systemic arterial hypertension (SAH), with the presence or not of cerebrovascular or cardiovascular diseases, will be included in the research.
Will be excluded from the study volunteers who have: history of epilepsy, intracranial abnormality, metal clips close to the region to be stimulated, pregnant or nursing women and immunosuppressed patients.
In each session, the patient will be expected to rest for 5 minutes after arrival to measure the BP, then using anodal and cathode electrodes previously moistened with saline solution or conductive gel located on the scalp, a constant electrical current will be applied from 0.1 μA at 10 MA transcranially, following the safety guidelines for the application of tDCS protocols. The protocol will be applied for 10 sessions, once a day for 20 minutes. In order to avoid an abrupt start and end of the current, the stimulation will be started and ended with a manual and gradual increase in intensity during a 20-second interval. BP measurements will be taken before, during and after stimulation.
Results: In this study, it is expected to understand the mechanism of systemic blood pressure control through transcranial direct current stimulation. Based on the literature, we infer that tDCS can be useful in regulating blood pressure in hypertensive individuals.
Funding: None
Conflict of Interest: None

V. Other

V.1. Nutritional Aspects and their Relation to Non-Invasive Neurostimulation as Adjuvant Treatment for Inpatients by Covid-19

Vanessa Meira Cintra[1], *Maria Cecília de Araújo Silvestre[1], Maria Thayná Bernardo Ferreira da Silva[1], Maria Paula de Paiva[1], Elaine Patrícia Barbosa Dias Diniz[1], Jailson Vilberto de Sousa e Silva[1], Jailane de Souza Aquino[1], Suellen Marinho Andrade [1].*
1. Universidade Federal da Paraíba (UFPB) - Federal University of Paraiba - Secretaria de Saúde do Estado da Paraíba (SES/PB) - Health Department of Paraíba

Objective: To identify the nutritional aspects and the relationship of non-invasive neurostimulation (HD-tDCS) as an adjuvant treatment for patients hospitalized for COVID-19.
Methods: Open label, controlled and randomized research with patients diagnosed with COVID-19

during hospitalization in the ICU. The database used was from June to July 2021 (30 patients). Patients using enteral diets and routine biochemical tests were included. Data from those who discontinued their diet during HD-tDCS treatment were excluded. The research worked with a neurostimulated group using the 4x1 HD-tDCS technique, with a 3mA stimulus, for 20 min, in non-consecutive sessions (14 sessions) for at least 7 days (T0 – baseline and T2 – final). And the simulated patients. The research was approved by the Research Ethics Committee (CAAE 44454621.6.0000.5186) and was registered on the ClinicalTrials.gov platform (Id: NCT04844554). Descriptive statistical analysis (mean, standard deviation and frequency) was performed.

Results: The final sample consisted of 16 individuals, mean age of 55 years (± 13.33), with both genders. It was observed that the protein means of the neurostimulated group increased between T0 and T2 (35.07 ± 11.67 and 41.25 ± 15.71) and the DLH test reduced 709.6 ± 279.4 and 596, 4± 135.93, unlike the sham group in both cases.

Conclusions: The prolonged hospitalization and the effects of COVID-19 favor the onset of sarcopenia and in neurostimulated patients there was better consumption, favoring muscle recovery. In addition, increased DLHL indicates a negative prognosis for COVID-19 and B12 alterations and there is a reduction in the neurostimulated group.

Funding: Soterix Medical Company

Conflict of Interest: None

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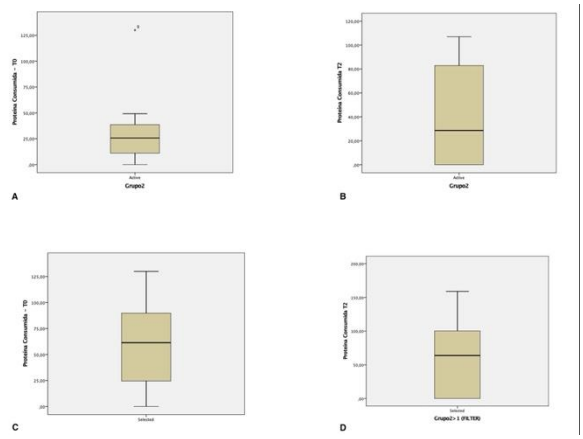

Figure 1. Graph of Medians between Neurostimulated Groups and Simulated by Consumed Protein. Survey, 2021. Observations: A – Medians consumed protein in T0 neurostimulated group by HD-tDCS / B - Medians consumed protein in T2 neurostimulated group by HD-tDCS / C - Medians consumed protein in T0 sham group / D - Medians consumed protein in T2 sham group

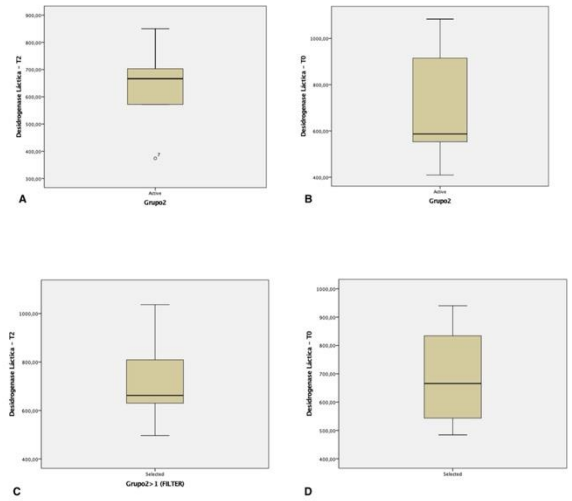

Figure 2. Graph of Means between Neurostimulated Groups and Simulated by Consumed Protein. Survey, 2021. Observations: A – Mean consumed protein in T0 neurostimulated group by HD-tDCS / B - Mean consumed protein in T2 neurostimulated group by HD-tDCS / C - Mean consumed protein in T0 sham group / D - Mean consumed protein in T2 sham group

V.2. The effects of Mindfulness-based relapse prevention in impulsivity and decision making for people with substance use disorders: a randomized controlled trial

Ana Paula Gonçalves Donate[1], *Itamar Felix Junior[1], Giovana Gonçalves Gallo[1], Elizeu Coutinho Macedo[2], Emérita Sátiro Opaleye[1], Ana Regina Noto[1].*
1. Núcleo de Pesquisa em Saúde e Uso de Substâncias - Departamento de Psicobiologia - Universidade Federal de São Paulo;
2.Laboratório de Neurociência Cognitiva e Social - Universidade Presbiteriana Mackenzie

Objective: We aimed to test whether employing the Mindfulness-Based Relapse Prevention (MBRP) could promote a better impulse control and improve decision making of inpatients with no previous experience in meditation in treatment for SUD compared to those undergoing treatment as usual (TAU).
Methods: A randomized controlled trial was conducted at a therapeutic community. An 8-week protocol of MBRP (2 hours/week) was delivered for experimental group (EG) plus standard treatment. The control group (CG) received TAU (standard treatment): 12 steps and relapse prevention group therapy. Multidimensional questionnaires were applied pre- and post-intervention assessing main impulsivity (UPPS-P) and decision making (IGT). Generalized Linear Models were employed to identify intervention effects.
Results: Our sample comprised 86 patients (87%) men, mean age = 40.8 (±10.2) (more information view Table 1). At baseline, the mean impulsivity of the EG was 48.4 and CG 48.0. After the intervention, groups pointed 45.1 and 43.4, respectively. Regarding decision making, the experimental group showed qualitative improvement in this construct. Nevertheless, no interaction effect was found for decision making and impulsivity.
Conclusions: MBRP when associated with TAU promoted qualitative improvements on decision making during the hospitalization due to SUD in Brazil. Considering neurobiology literature, is expected increase ACC/ PFC activity in novice meditators. However, specific impairments in consequence of specific SUD, aging and previous cognitive conditions per se could demand more PCF resources to expressive changes than an 8-week mindfulness intervention. Future studies were suggested: 1. specific adaptations on the MBRP protocol; 2. the implementation of MBRP + tDCS over the right dlPFC to investigate the possible boost effects of this association on impulsivity; 3. Investigate effects of MBRP on event-related potentials, such as error-related negativity (ERN), N2, and error positivity (Pe) on SUD.
Funding: FAPESP Temático Process Number: 15/19472-5
Conflict of Interest: None

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Table 1.

	UPPS-P TOTAL			IGT TOTAL		
Preditors	*Estimatives*	*IC*	*p*	*Estimatives*	*IC*	*p*
(Intercept)	55.50	48,64 – 62,35	**<0,001**	10,59	-9,73 – 30,92	**0,309**
Group [MBRP]	1,73	-1,82 – 5,28	0,342	7,05	-3,46 – 17.56	0,191
Time	-1,9	-5,89 – 2,08	0,351	-3,26	-14,88 – 8,36	0,583
Age	-0,16	-0,30 – -0,03	**0,02**	-0,3	-0,69 – 0,09	**0,131**
Gender [1]	0,98	-3,51 – 5,47	0,67	-10,94	-23,76 – 1,89	0,098
Education [2]	-4,75	-8,16 – -1,33	**0,007**	2,39	-7,26 – 12,05	**0,628**
Education [3]	-4,905	-8,92 – -0,97	**0,016**	6,43	-5,08 – 17,94	**0,276**
Abstinence (days)	0,03	-0,03 – 0,09	0,305	-0,2	-0,37 – -0,04	0,018
Previous Treatments	1,4	-1,48 – 4,29	0,342	-1,19	-9,43 – 7,05	0,778
MBRP * Time	-2,83	-8,29 – 2,63	0,311	11,79	-3,92 – 27,49	0,144
Observations	130			116		
R^2 Nagelkerke	1			1		
AIC	911.702			1.047.441		

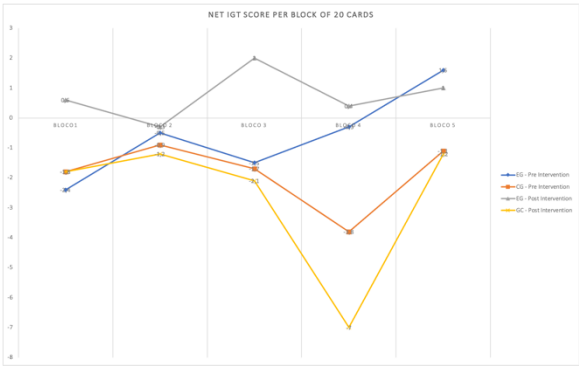

Figure 1.