UNIVERSIDADE FEDERAL DE CIÊNCIAS DA SAÚDE DE PORTO ALEGRE
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IMAGINATION AND OBSERVATION OF ACTION IN THE REHABILITATION OF MOTOR SKILLS IN PEOPLE WITH PARKINSON'S DISEASE: A SYSTEMATIC REVIEW OF RANDOMIZED CLINICAL TRIALS

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Trabalho de Conclusão de Curso de Fisioterapia, da Universidade Federal de Ciências da Saúde de Porto Alegre, como requisito parcial para obtenção do título de Bacharel em Fisioterapia

Orientador: Fernanda Cechetti

Coorientador: Kátine Marchezan Estivalet

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BANCA EXAMINADORA

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Prof.(a) RODRIGO DELLA MÉA PLENTZ

Prof.(a) JOCIANE SCHARDONG

Para as minhas maiores fontes de ensinamentos e inspiração, meus pais.

AGRADECIMENTOS

Ao concluir este trabalho, quero agradecer…

… aos meus pais, Alessandra de Oliveira Mendes *(in memorian)* e Alexandre Chesini Mendes que foram incansáveis em me ensinar a seguir meus sonhos e sempre foram meu maiores exemplos. E à Belinha *(in memorian)* e Any por serem minhas maiores parceiras de vida.

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… à minha família e amigos por estarem ao meu lado durante todos os desafios desta trajetória.

RESUMO

Introdução: A imagética motora (IM) e a observação da ação (OA) são duas abordagens promissoras na reabilitação da função motora em indivíduos com a doença de Parkinson (DP). Elas podem ser utilizadas de forma isolada ou combinada e apresentam potencial para a melhora do controle motor, desacelerar a progressão da doença e promover mudanças plásticas no córtex motor. Apesar da OA e IM demonstrarem resultados positivos, dando-lhes maior autonomia e diminuindo o freezing da marcha, há poucos estudos que abordem suas ações de forma combinada, indicando a necessidade de estudos que atualizem os protocolos utilizando a OA e a IM no tratamento de pessoas com a DP. **Métodos**: A revisão sistemática seguiu as diretrizes PRISMA e foi registrada no PROSPERO (CRD42023428047). As buscas ocorreram entre junho e agosto de 2023, com uma nova busca para atualização em maio de 2024 em bases de dados como PubMed, EMBASE, Cochrane, LILACS e PEDro, selecionando ensaios clínicos randomizados e estudos pilotos publicados nos últimos 10 anos. Os estudos deveriam avaliar os efeitos motores da IM e OA em pessoas com a DP, sem restrições de estágio, sexo ou tempo da doença. Estudos experimentais e incompletos foram excluídos. O principal desfecho analisado foi a parte III da escala Unified Parkinson's Disease Rating Scale (UPDRS) utilizada para avaliar os sintomas motores da DP. Dois revisores realizaram a seleção de estudos e resolveram divergências por consenso ou com um terceiro revisor. Dados como características da amostra, intervenção e resultados foram extraídos usando um formulário padronizado. A qualidade metodológica foi avaliada pela escala PEDro, considerando como alta qualidade estudos com pontuação ≥5. **Resultados**: Após os critérios de exclusão, foram selecionados seis estudos para esta revisão sistemática. Ao total foram analisados 152 participantes entre 63 e 76 anos, com prevalência do estágio 2 na Escala Hoehn e Yahr. As intervenções incluíram OA em três estudos, IM em dois, e uma combinação de OA e IM em um estudo. As sessões variaram de 2 a 8 semanas, com 60 a 120 minutos por sessão, totalizando 8 a 28 sessões. **Discussão**: A DP gera efeitos deletérios no equilíbrio, marcha e habilidades manuais. E a OA e a IM são intervenções que melhoram os sintomas motores e qualidade de vida. A revisão destacou que a OA ajuda no equilíbrio, na marcha e no congelamento da marcha, enquanto a IM auxilia no equilíbrio, risco de quedas e habilidades motoras. Um estudo utilizou a OA e IM de forma combinada e apresentou resultados significativos, sugerindo benefícios na reorganização funcional cerebral. Apesar dos avanços, há necessidade de mais pesquisas sobre funções motoras dos membros superiores e combinações das técnicas. **Conclusão**: Este estudo analisou seis estudos que avaliaram as funções motoras nas pessoas com DP a partir do UPDRS-III. A maioria dos estudos mostrou melhora significativa nas habilidades motoras após intervenções com OA, IM ou uma combinação das duas. E destaca a falta de estudos realizados para avaliar os efeitos destas abordagens na função motora e funcionalidade nos membros superiores.

Palavras-chave: Doença de Parkinson, Função motora, Imagética motora, Neurorreabilitação, Observação da ação, Prática mental

ABSTRACT

Introduction: Motor imagery (MI) and action observation (AO) are two promising approaches in the rehabilitation of motor function in individuals with Parkinson's disease (PD). They can be used either separately or combined and have the potential to improve motor control, slow disease progression, and promote plastic changes in the motor cortex. Although AO and MI show positive results, providing greater autonomy and reducing freezing of gait, there are few studies that address their combined effects, indicating the need for studies that update protocols using AO and MI in the treatment of individuals with PD. **Methods**: The systematic review followed the PRISMA guidelines and was registered in PROSPERO (CRD42023428047). The searches took place between June and August 2023, with an additional search for updates in May 2024 in databases such as PubMed, EMBASE, Cochrane, LILACS, and PEDro, selecting randomized clinical trials and pilot studies published in the last 10 years. The studies should evaluate the motor effects of MI and AO in individuals with PD, without restrictions on stage, sex, or disease duration. Experimental and incomplete studies were excluded. The primary outcome analyzed was part III of the Unified Parkinson's Disease Rating Scale (UPDRS), used to assess motor symptoms of PD. Two reviewers conducted the study selection and resolved disagreements by consensus or with a third reviewer. Data such as sample characteristics, intervention, and outcomes were extracted using a standardized form. The methodological quality was assessed using the PEDro scale, considering studies with a score ≥5 as high quality. **Results**: After applying the exclusion criteria, six studies were selected for this systematic review. A total of 152 participants aged between 63 and 76 years were analyzed, with a prevalence of stage 2 on the Hoehn and Yahr Scale. The interventions included AO in three studies, MI in two, and a combination of AO and MI in one study. The sessions ranged from 2 to 8 weeks, with 60 to 120 minutes per session, totaling 8 to 28 sessions. **Discussion**: PD has detrimental effects on balance, gait, and manual skills. AO and MI are interventions that improve motor symptoms and quality of life. The review highlighted that AO helps with balance, gait, and freezing of gait, while MI assists with balance, fall risk, and motor skills. One study used AO and MI combined and showed significant results, suggesting benefits in brain functional reorganization. Despite advances, further research is needed on upper limb motor functions and combinations of the techniques. **Conclusion**: This study analyzed six studies that assessed motor functions in individuals with PD using the UPDRS-III. Most studies showed significant improvement in motor skills after interventions with AO, MI, or a combination of both. It also highlights the lack of studies evaluating the effects of these approaches on motor function and upper limb functionality.

Key words: Parkinson's Disease, Motor Function, Motor Imagery, Neurorehabilitation, Action Observation, Mental Practice.

SUMÁRIO

REFERENCES

Abbruzzese, G., Avanzino, L., Marchese, R., & Pelosin, E. (2015). Action observation and motor imagery: Innovative cognitive tools in the rehabilitation of Parkinson's disease. *Parkinson's Disease, 2015*, 124214. https://doi.org/10.1155/2015/124214

Agosta, F., Gatti, R., Sarasso, E., Volonté, M. A., Canu, E., Meani, A., Sarro, L., Copetti, M., Cattrysse, E., Kerckhofs, E., Comi, G., Falini, A., & Filippi, M. (2017). Brain plasticity in Parkinson's disease with freezing of gait induced by action observation training. *Journal of Neurology, 264*(1), 88–101. https://doi.org/10.1007/s00415-016-8309-7

Abraham, A., Hart, A., Andrade, I., & Hackney, M. E. (2018). Dynamic neuro-cognitive imagery improves mental imagery ability, disease severity, and motor and cognitive functions in people with Parkinson's disease. *Neural Plasticity, 2018*, 6168507. https://doi.org/10.1155/2018/6168507

Bek, J., Gowen, E., Vogt, S., Crawford, T. J., & Poliakoff, E. (2018). Combined action observation and motor imagery influences hand movement amplitude in Parkinson's disease. *Parkinsonism & Related Disorders, 61*, 126–131. https://doi.org/10.1016/j.parkreldis.2018.11.001

Bek, J., Webb, J., Gowen, E., Vogt, S., Crawford, T. J., Sullivan, M. S., & Poliakoff, E. (2016). Patients' views on a combined action observation and

motor imagery intervention for Parkinson's disease. *Parkinson's Disease, 2016*, 7047910. https://doi.org/10.1155/2016/7047910

Bek, J., Holmes, P. S., Craig, C. E., Franklin, Z. C., Sullivan, M., Webb, J., Crawford, T. J., Vogt, S., Gowen, E., & Poliakoff, E. (2021). Action imagery and observation in neurorehabilitation for Parkinson's disease (ACTION-PD): Development of a user-informed home training intervention to improve functional hand movements. *Parkinson's Disease, 2021*, 4559519. https://doi.org/10.1155/2021/4559519

Caligiore, D., Mustile, M., Spalletta, G., & Baldassarre, G. (2017). Action observation and motor imagery for rehabilitation in Parkinson's disease: A systematic review and an integrative hypothesis. *Neuroscience & Biobehavioral Reviews, 72*, 210–222. https://doi.org/10.1016/j.neubiorev.2016.11.005

Giannakopoulos, I., Karanika, P., Papaxanthis, C., & Tsaklis, P. (2022). The effects of action observation therapy as a rehabilitation tool in Parkinson's disease patients: A systematic review. *International Journal of Environmental Research and Public Health, 19*(6), 3311. https://doi.org/10.3390/ijerph19063311

Giorgi, G., Ferrarello, F., Merlo, F., Fumagalli, S., Marchionni, N., & Di Bari, M. (2018). First-person perspective action observation training in individuals with Parkinson's disease: A consideration-of-concept controlled pilot trial. *Journal of*

Geriatric Physical Therapy, 41(3), 134–142. https://doi.org/10.1519/JPT.0000000000000113

Maher, C. G., Sherrington, C., Herbert, R. D., Moseley, A. M., & Elkins, M. (2003). Reliability of the PEDro Scale for rating quality of randomized controlled trials. *Physical Therapy, 83*(8), 713–721.

Mezzarobba, S., Grassi, M., Pellegrini, L., Catalan, M., Kruger, B., Furlanis, G., Manganotti, P., & Bernardis, P. (2018). Action observation plus sonification: A novel therapeutic protocol for Parkinson's patients with freezing of gait. *Frontiers in Neurology, 8*, 723. https://doi.org/10.3389/fneur.2017.00723

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Group, P. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Open Medicine, 3*(3), e123–e130. https://doi.org/10.1136/bmj.b2535

Rizzi, B., Nuresi, C., Rovacchi, C., Bacchini, M., Savi, F., Falco, L., Schianchi, L., Scaglione, A., Ciracì, C., Constantino, C., & Buccino, G. (2022). Motor imagery and action-observation in neurorehabilitation: A study protocol in Parkinson's disease patients. *Frontiers in Neurology, 13*, 990618. https://doi.org/10.3389/fneur.2022.990618

Sarasso, E., Gemma, M., Agosta, F., Filippi, M., & Gatti, R. (2015). Action observation training to improve motor function recovery: A systematic review. *Archives of Physiotherapy, 5*(14). https://doi.org/10.1186/s40945-015-0013-x

Sarasso, E., Agosta, F., Piramide, N., Gardoni, A., Canu, E., Leocadi, M., Castelnovo, V., Basaia, S., Tettamanti, A., Volonté, M. A., & Filippi, M. (2021). Action observation and motor imagery improve dual task in Parkinson's disease: A clinical/fMRI study. *Movement Disorders, 36*(11), 2569–2582. https://doi.org/10.1002/mds.28717

Silva, D. M., Coriolano, M. G. W., Macêdo, J. G. F., Silva, L. P., & Lins, O. G. (2016). Practice of mental protocols used in rehabilitation of patients with Parkinson’s disease: A systematic review. *Acta Fisiatrica, 23*(3), 155–160. https://doi.org/10.5935/0104-7795.20160030

Temporiti, F., Adamo, P., Cavalli, E., & Gatti, R. (2020). Efficacy and characteristics of the stimuli of action observation therapy in subjects with Parkinson's disease: A systematic review. *Frontiers in Neurology, 11*, 808. https://doi.org/10.3389/fneur.2020.00808

Tinaz, S., Kamel, S., Aravala, S. S., Elfil, M., Bayoumi, A., Patel, A., Scheinost, D., Sinha, R., & Hampson, M. (2022). Neurofeedback-guided kinesthetic motor imagery training in Parkinson's disease: Randomized trial. *NeuroImage: Clinical, 34*, 102980. https://doi.org/10.1016/j.nicl.2022.102980

ANEXO

ANEXO A - NORMAS DA REVISTA ESCOLHIDA PARA SUBMISSÃO DO ARTIGO

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Manuscripts should be organized in the following order:

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- Abstract
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- Statements (Acknowledgements, Declaration of interest, Ethics statement, Informed consent, Funding statement)
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The title page should provide the following information:

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The abstract should be clear, descriptive, self-explanatory and not longer than 200 words. The abstract should be suitable for publication in abstracting services. The abstract for research papers should follow the “structured abstract” format. Section labels should be in bold uppercase letters followed by a colon, and each section will begin on a new line.

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Research articles should be structured as outline above. Submissions must not exceed 25 pages, excluding references, tables and figures.

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Brief reports are articles of original scholarship of unusual interest of less than 1500 words (excluding references). They should be structured as research articles (see above) and may have a structured abstract. A total of two tables and/or figures are allowed.

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Anderson, A. K. (2005). Affective influences on the attentional dynamics supporting awareness. Journal of Experimental Psychology: General, 154, 258–281.

Anderson, A. K., Christoff, K., Panitz, D., De Rosa, E., & Gabrieli, J. D. E. (2003). Neural correlates of the automatic processing of threat facial signals. Journal of Neuroscience, 23, 5627–5633.

Armony, J. L., & Dolan, R. J. (2002). Modulation of spatial attention by fear-conditioned stimuli: An event-related fMRI study.Neuropsychologia, 40, 817–826.

Beck, A. T., Epstein, N., Brown, G., & Steer, R. A. (1988). An inventory for measuring clinical anxiety: Psychometric properties. Journal of Consulting and Clinical Psychology, 56,893–897.

Calvo, M. G., & Lang, P. J. (2004). Gaze patterns when looking at emotional pictures: Motivationally biased attention. Motivation and Emotion, 28, 221–243.

Carretie, L., Hinojosa, J. A., Martin-Loeches, M., Mecado, F., & Tapia, M. (2004). Automatic attention to emotional stimuli: Neural correlates.Human Brain Mapping, 22, 290–299.

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