Non-Pharmacological Intervention Society

Non Pharmacological Interventions Registry

Protocol : BeatMove Parkinson Program

Health Problem : Risk of fall

Bodily

Sheet Code
NPIS-000000027

Designation

BeatMove Parkinson Program

Abbreviation

BeatPark

Category

Bodily

Main Health benefit

Improving the walking ability of patients with Parkinson's disease.

Explanation

BeatMove analyzes the user's walking pace to play synchronized music, then gradually speeds it up as the user increases their walking pace.

- 4% increase in walking distance on the TDM6 after INM
- 3% increase in walking speed on the TDM6 after INM
- 3% increase in walking cadence at TDM6 after INM,
- 3% increase in walking speed at TDM6 after INM,
- 2% increase in stride length at TDM6 after INM.

(Cochen De Cock et al., 2021)

Routine Test

6-minute walk test (TDM6).

Threshold

The threshold must be calculated individually using the following equations according to gender (Enright & Sherrill, 1998):

- Men: DistanceTDM6 = (7.57 x HeightCM) - (5.02 x Age) - (1.76 x WeightKG) - 309 m
- Women: DistanceTDM6 = (2.11 x HeightCM) - (2.29 x WeightKG) - (5.78 x Age) + 667 m

Minimal Clinically Important Change

- 0.02 m/s for a slight effect,
- 0.06 m/s for a moderate effect,
- 0.09 m/s for a significant effect.

(Hass et al., 2014)

Secondary benefits

Compared to pre-/post-program deltas:

- Improved quality of life ($p=0.03$),
- Decreased apathy ($p=0.02$).

During the program compared to baseline:

- Increased energy expenditure during brisk walking ($p<0.005$),
- Increased frequency of moderate-intensity physical activity and walking ($p<0.001$),
- Decrease in the number of falls ($p=0.01$),
- Decrease in perceived pain ($p=0.02$).

(Cochen De Cock et al., 2021)

Direct Risks

- Possible falls during the program, even though the trend is toward a decrease in the number of falls during the program;
- Fatigue, despite no significant difference;

Compliance with the program was 78.8% of the prescribed duration.
Patients completed an average of 15.9 of the 20 prescribed sessions.
Patients with compliance below 50% were those with the most difficulties in daily motor activities.
Enjoyment of the program (PACES scale) was reported as sufficient for more than 90% of participants throughout the program.
(Cochen De Cock et al., 2021)

Risks of interaction

None observed to date.

Biological and Psychosocial Mechanisms

Auditory rhythmic indexing is based on a temporal prediction and synchronization model involving two underlying neural networks (Dalla Bella et al., 2015):

- The basal ganglia-thalamocortical (BGTC) network, which is involved in attention-dependent evaluation of time intervals and in the self-generation of movements. This network is involved in triggering action and explicit timing (i.e., the overt estimation of stimulus duration).
- The cerebellar-thalamo-cortical (CTC) network, which is involved in pre-attentive coding of event-based temporal structure and in adapting movements to exogenous signals (Kotz & Schwartze, 2011; Coull, Cheng & Meck, 2011).

Listening to music, a pleasant and enriching activity (Sihvonen et al., 2017), also has an effect on the dopaminergic system (Ferreri et al., 2019), which is defective in Parkinson's disease.

Responding population

People diagnosed with Parkinson's disease according to the Queen Square Brain Bank criteria (Hughes et al., 1992), with moderate severity of the disease: Hoehn & Yahr stage I to III (Hoehn & Yahr, 1967) and presenting with gait disorders: Item 10 of the MDS-UPDRS-III scale greater than or equal to 1 and less than 3 (Martinez-Martin, et al., 2013).

Nonresponding population

Following an initial clinical study showing patients who did not respond to rhythmic auditory stimulation (Cochen De Cock et al., 2018), we developed an algorithm that performs the synchronization work on behalf of patients and selects dedicated, individualized music so that all patients respond. (patent WO 2019020755 A1)
There are therefore no longer any non-responders in our 2021 study, the results of which form the basis of this NPI Card.

Participants

Individual

Duration

4 weeks

Sessions per week

5 sessions of 30 minutes.

Procedure

1 - Initial assessment and prescription of beatMove by the neurologist,

2 - Individual use of the Digital Medical Device (DMD),

3 - Interim follow-up by the physical therapist and/or general practitioner,

4 - Extension, if necessary, of the beatMove prescription by the neurologist during the next

medical visit, potentially in conjunction with the follow-up carried out by the physical therapist and/or general practitioner.

Components

30-minute walking sessions 5 times a week for 1 month using beatMove, which provides rhythmic auditory stimulation in phase thanks to a patented synchronization algorithm that does the synchronization work for the user.
This algorithm detects when the foot hits the ground to synchronize dedicated, individualized music based on the user's walking pace. The algorithm then gradually increases the tempo of the music while checking, through an iterative loop, that the user is keeping up with the acceleration.
(For more details, please refer to the fields "Biological and psychosociological mechanisms“ and "Bibliography"; as well as patent WO 2019020755 A1).

Equipment

BeatMove app downloaded onto a smartphone + headphones.
Comfortable walking shoes and clothing.

Location

Preferable: parks, tracks or sports fields, walking paths, pedestrian areas, wide and even hiking trails, seaside promenades.
Avoid: uneven hiking trails, areas with repeated stairs, areas with repeated crosswalks or traffic, areas with large crowds of people, sand, and water.

Best implementation practices

Practice in a safe place.
Recommend drinking water before you feel thirsty (before, during, and after).
Recommend wearing glasses and hearing aids if necessary.
Recommend wearing appropriate shoes and clothing.
Organize a five-minute recovery phase at the end of the session to refocus on sensations and encourage daily physical activity.
Know how to call for help in case of a problem.

Feel free to consult the French National Authority for Health fact sheet on physical activity for Parkinson's disease (2022) (Document in French). LINK

Best practices for sustainability

Encourage continued independent walking.
Encourage other physical activities (gardening, housework, walking, dancing, cultural outings, etc.).

Precautions

Ensure that the exercise is performed without pain, particularly in cases of osteoarthritis, osteoarticular and musculotendinous disorders, osteoporosis, or painful conditions.
Ask the person to contact their doctor in case of chest pain, persistent muscle pain, difficulty breathing, dizziness, or a severe fall.
Suggest the use of a hip protector cushion in case of repeated falls.

Regulatory specification

Prescription by a neurologist.
Free of charge, but the practitioner must systematically cite the NPI.

Main Initiator

Benoît Bardy, Valérie Cochen De Cock, and Simone Dalla Bella, Euromov Laboratory, UFR STAPS, University of Montpellier, Montpellier, France.

Qualification required

Self-rehabilitation monitored by a neurologist, in conjunction with the general practitioner and/or physical therapist. (HAS, 2021).
As the severity of the condition is moderate, an Adapted Physical Activity Instructor (EAPA) may also be involved.

References

Prototype study

Cochen De Cock et al. "Rhythmic abilities and musical training in Parkinson's disease: do they help?." NPJ Parkinson's disease 4.1 (2018): 8. https://doi.org/10.1038/s41531-018-0043-7

Mechanistic study

Dalla Bella et al. "Effects of musically cued gait training in Parkinson's disease: beyond a motor benefit." Annals of the New York Academy of Sciences 1337.1 (2015): 77-85. https://doi.org/10.1111/nyas.12651

Dotov et al. "The role of interaction and predictability in the spontaneous entrainment of movement." Journal of Experimental Psychology: General 148.6 (2019): 1041. https://doi.org/10.1037/xge0000609

Interventional studies

Cochen De Cock et al. BeatWalk: Personalized music-based gait rehabilitation in Parkinson's disease. Frontiers in Psychology 2021 ; 12 : 655121. https://doi: 10.3389/fpsyg.2021.655121

Bourdon et al. Gait ecological assessment in persons with Parkinson's disease engaged in a synchronized musical rehabilitation program. npj Parkinson's Disease 2025 11(1) : 12 https://doi.org/10.1038/s41531-024-00852-6

Risk assessment

Cochen De Cock et al. BeatWalk: Personalized music-based gait rehabilitation in Parkinson's disease. Frontiers in Psychology 2021 ; 12 : 655121. https://doi: 10.3389/fpsyg.2021.655121

Implementation study in Europe

Bourdon et al. Gait ecological assessment in persons with Parkinson's disease engaged in a synchronized musical rehabilitation program. npj Parkinson's Disease 2025 11(1) : 12 https://doi.org/10.1038/s41531-024-00852-6

Other publications

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Enright et al. "Reference equations for the six-minute walk in healthy adults." American journal of respiratory and critical care medicine 158.5 (1998): 1384-1387. https://doi.org/10.1164/ajrccm.158.5.9710086

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Hughes et al. "Accuracy of clinical diagnosis of idiopathic Parkinson's disease: a clinico-pathological study of 100 cases." Journal of neurology, neurosurgery & psychiatry 55.3 (1992): 181-184. https://pmc.ncbi.nlm.nih.gov/articles/PMC1014720/pdf/jnnpsyc00488-0011.pdf
Kotz et al. "Differential input of the supplementary motor area to a dedicated temporal processing network: functional and clinical implications." Frontiers in Integrative neuroscience 5 (2011): 86. https://doi.org/10.3389/fnint.2011.00086
Martinez-Martin et al. "Expanded and independent validation of the movement disorder society–unified Parkinson's disease rating scale (MDS-UPDRS)." Journal of neurology 260.1 (2013): 228-236. https://doi.org/10.1007/s00415-012-6624-1
Sihvonen et al. "Music-based interventions in neurological rehabilitation." The Lancet Neurology 16.8 (2017): 648-660. https://doi.org/10.1016/S1474-4422(17)30168-0

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