Rhythm, Music, Singing, Dancing, and the Brain

Notes on some selected research from a person living with Parkinson’s

Robert J. Kamper, PhD.
Overture

• What is “the Parkinson’s” (PD)?
• What does current research say (generally speaking)?
• What does the research on rhythm, music, singing and dance (so far) tell us?
• What should a person with PD do?
First Movement

What is “the Parkinson’s” (PD)?
What is “The Parkinson’s”?

- “Incurable,”
- Progressive,
- Degenerative,
- Neurological disease

- Described by James Parkinson as “The Shaking Palsy” in 1817
Clinical diagnosis is STILL based on observation of cardinal symptoms described 2 centuries ago:

- **Bradykinesia** (slow movement & impaired ability to move the body swiftly on command).

and at least one of the following:

- **Resting tremor** (involuntary trembling of the body or limbs).
- **Rigidity** (Stiffness and inflexibility of the limbs, neck or trunk)
- **Postural instability** (balance issues).
New Criteria

(2015)
• Movement Disorders Society publication of “prodromal” symptoms and diagnostic criteria “for research”

(2018)
• “Survey showed that, although innovative and complete, the revised diagnostic criteria produced by MDS task force are still scarcely employed among clinicians.”
Prodromal & Nonmotor Symptoms

• PD associated with non-motor features
  • *Sleep disturbances, (RSBD)* - Highest predictive value \( \sim 80\% \)
  • *Mood disorders, (MDD)*, Hyposmia, constipation, cognitive impairment

• Combination of 2 or more prodromal symptoms = 4x risk for PD

• **Essential tremors** have been linked genetically to PD risk (LINGO1 gene, increased risk \( \sim 2x \) for both ET and PD)
In General…

(2018) Movement Disorders Society review:
- Evidence based treatments for motor symptoms
- No interventions currently available to delay/slow motor symptoms
- Options for treatment continue to expand

Adjunct/alternative/complementary therapies
- “Insufficient evidence” that exercise helps
First Ending

To sum it up:
• Exercise has **NOT** been shown to slow the progression of PD symptoms, in general.
• Exercise **IS** good for the body and the brain/mind **BUT**
  – All forms of exercise improve cognitive functions
  – Aerobic exercise improves memory functions (2019)

But is “exercise” enough?
Second Movement

singing

making music

dancing
Time to Face the Music...

• “As far back” as 2000...
  – “Active Music Therapy”
    • choral singing
    • voice exercises
    • rhythmic & fine body movements
    • active music involving collective invention
  – Significant difference (SD) in bradykinesia, activities of daily living, Quality of Life (QOL)
  – Physical Therapy (PT) included stretching, motor tasks, strategies for gait
    • PT improved rigidity
Singing versus Aging

(2006) Creativity and Aging - professionally conducted cultural program (choral groups)

- Overall health improved
- Fewer doctor visits (SD for treatment group)
- Fewer prescribed medications
- Fewer OTC medications
- Depression scale scores improved

(Not People with Parkinson’s - but possibly generalizable)
Singing versus Neurological Disorders

Therapeutic effects of singing in neurological disorders (2010)

- Parkinson’s & other disorders
- Neuroimaging used

• Singing helps
  - Regulate speech
  - Improve cardio & pulmonary health
  - Improve expressive language
  - Influence emotional regulation
  - Influence mirror neuron system
Neurochemistry of Music

Meta study of 200 studies on benefits of music (2013)

– Music and singing:
  • Engage systems for reward, motivation, pleasure, stress/arousal, immunity and social affiliation
  • Stimulate release of dopamine
  • Reduce stress
  • Increase oxytocin levels/social affiliation
  • Can modify/regulate autonomic systems
A Song in Your Heart

• (2018) SINGING (internal cue) while walking improved **gait, stride and speed (PD)**
  – External stimulus (RAS) provided no significant difference over no stimulus.
  – Conclusion, sing while walking to improve gait, etc.

• Did not test whether “in the head” singing made a difference.

• (Study used “Row, Row, Row Your Boat” as the auditory cue - generalizable?)

RAS: Rhythmic Auditory Stimulation
Therapeutic Singing

(2018) Individual therapeutic singing intervention

Treatment consisted of

- Vocalization
- Breathing techniques
- Larynx and voice exercises
- Auditory feedback
Therapeutic Singing continued

Results:

• Measurements

  • Maximum phonation time
  • Voice handicap index
  • Voice related QOL
  • Geriatric depression scale

• Significant difference on all scales over pre-treatment
Making Music

Engaging the whole brain
We Got The Beat

DRUM-PD (2016)

- West African drum circles 2 x week for 6 weeks
- Significantly improved QOL scores*
- Improved connection with peers*

- But - reversible:
  - QOL declined after classes stopped*

*(measures are surveys, not neuroimaging data)
Rationale for Music Training

(2018) Review and rationale for new direction in music therapy for PD

• Rhythmic Auditory Stimulation (RAS) has been shown to improve mobility, balance, and gait (But providing your own RAS through singing is even better)

• However, RAS not shown to prevent cognitive decline
Hypothesis: Keyboard training can improve executive functions through neural plasticity

- Fine motor skills enhance cognitive performance
- Music training improves connections between brain hemispheres
- Possible creation of new neural adaptations (to compensate for the decline of “normal” frontal cortex to motor systems pathways)
Dance
Dance
Dance
Dance
Dance for Neuroplasticity

Review (2018)

• Dance practice integrates brain areas
• Connections between both hemispheres

• Structural
  – Increased volume in gray matter
  – Increased integrity of white matter

• Functional improvements
  – Memory
  – Attention
  – Body balance
  – Psycho-social

*(There are many more studies)*
Dance: Better for the Brain

Dance training is superior to repetitive physical exercise in inducing brain plasticity in the elderly

• Extensive pre/post-assessment
  • general cognition,
  • attention,
  • memory,
  • postural and cardio-respiratory performance,
  • neurotrophic factors and
  • MRI
Dance: Better for the Brain

Results:
• **Both** interventions increased physical fitness
• Pronounced differences were seen in **brain volumes**:
  – *Dancing* vs. conventional fitness activity
  • Larger volume increases in more brain areas,
    • cingulate cortex, insula, corpus callosum and sensorimotor cortex.
• Only dancing associated with increase in **plasma Brain-Derived Neurotrophic Factor (BDNF)** levels.
• **Cognition**:
  – both improved in **attention** and **spatial memory**, but no SD.
  – May indicate that cognitive benefits develop later - after structural brain changes.
2nd Ending

• Much of research on music’s impact on the brain
  • musicians vs. non-musicians
  • Few if any involve people with Parkinson’s
  • Much limited to affect and surveys
• NEED studies into effects of music/dance/singing interventions on the brains of people with neuro-degenerative diseases.
• NEED studies into individual treatments as well as combinations of treatments.
  – Singing
  – Dancing
  – Playing musical instruments
  – Collective invention/improvisation
Repeat

• A lot has been learned since 2012 about PD
• There is still a lot to be learned
• “Exercise” by itself: Doesn’t delay the progression of PD
• Not enough research has been done with rigorous methodology and information on brain functions to say what the impact of dance, music training, and singing is - or could be
• In theory, music/singing/dance can build new neural connections in the brain
• So
  – Don’t stop moving to the music
Coda

• DISCLAIMER:
  • This presentation is biased towards the hypothesis that music, playing music, singing, dancing and improvisation are good things to do - whether you have Parkinson’s or not.

• Repeat:
  • music,
  • playing music,
  • singing,
  • dancing and
  • improvisation / “collective invention”

• Are Good For You - any age, any state of health
Finale

- This is the end...

Thank You!
References

Slide 3
- Parkinson, James (1817) An Essay on the Shaking Palsy

Slide 4
- The Concept of Prodromal Parkinson’s Disease
  - https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4927924/

Slide 5
- Premotor and Non-motor Symptoms of Parkinson’s Disease
  - https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4181670/
- Time to redefine PD?
  - https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4204150/

Slide 6
- MDS research criteria for prodromal Parkinson's disease.
References

Slide 7
- Premotor and non-motor features of Parkinson’s disease
  - https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4181670/
- Recent advances in treating Parkinson’s disease
  - https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5357034/
- LINGO1 rs9652490 is associated with Essential Tremor and Parkinson Disease
  - https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2844122/

Slide 8
- International Parkinson and movement disorder society evidence-based medicine review: Update on treatments for the motor symptoms of Parkinson's disease.

Slide 9
- The Effect of Different Exercise Modes on Domain-Specific Cognitive Function in Patients Suffering from Parkinson's Disease: A Systematic Review of Randomized Controlled Trials.
References

Slide 11
- Active music therapy in Parkinson's disease: an integrative method for motor and emotional rehabilitation.

Slide 12
- The Creativity and Aging Study

Slide 13
- The Therapeutic Effects of Singing in Neurological Disorders.

Slide 14
- The neurochemistry of music.
References

Slide 15
- Internal cueing improves gait more than external cueing in healthy adults and people with Parkinson disease
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6195608/

Slides 16-17
- Individual Therapeutic Singing Program for Vocal Quality and Depression in Parkinson’s Disease
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6182306/

Slide 19
- DRUM-PD: The Use of a Drum Circle to Improve the Symptoms and Signs of Parkinson's Disease (PD)
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4914050/
A Rationale for Music Training to Enhance Executive Functions in Parkinson’s Disease: An Overview of the Problem
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6023482/

Dance training is superior to repetitive physical exercise in inducing brain plasticity in the elderly (2019)
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6040685/

Dance training is superior to repetitive physical exercise in inducing brain plasticity in the elderly
This ends this presentation as of June 4, 2019. It may be revised as new information becomes available.

Research will continue,
• For better treatments of symptoms,
• Better diagnosis for risk and early onset, perhaps
• Ways to delay the progress of symptoms, and
• Cure(s) for Parkinson’s Disease

Thank you for your interest. Please support research and programs that provide services to people with PD.

This presentation © 2019 by Robert Kamper
(May be used in classrooms under the Fair Use guidelines. Other uses please contact the author for permission).