Exercise for HD

Chris Lamb, PT, DPT, ATC/LAT
4th Annual HDSA Convention
2nd year Presenter
HD Advocate in Washington DC
Graduated University of North Florida with Doctoral Degree in Physical Therapy 2012
Graduated University of North Florida with Bachelor’s Degree in Athletic Training 2009
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Presenter Disclosures

Dr. Chris Lamb

The following personal financial relationships with commercial interests relevant to this presentation existed during the past 12 months:

No relationships to disclose or list
Outline of Presentation

• Role of Physical Therapist in Huntington's Disease.
• Role of exercise in Huntington’s Disease.
• Lab session for exercises
Summary of Impairments and Activity Limitations Treated by Physical Therapist in Huntington’s Disease (HD)

- Gait and balance training to prevent falls.
- Aerobic capacity and strength training.
- Joint range of motion.
- Respiratory function.
- Transfers/Mobility.
- Wheelchair prescription and training.
- Relaxation.
- Dystonia Management.
- Prevent of contractures.
- Prescription of safety equipment.
- Care giver education.
- Postural Training
- Environmental Alterations
Huntington’s Disease During the Four Stages

• Four stages consist of Pre-Onset Stage, Early Stage Onset, Mid stage, and Late stage.
Pre-Onset Stage of Huntington’s Disease focus of Physical Therapy

• The stage at which the person has no motor and cognitive sign and symptoms.
• Aerobic capacity and strength training.
• Respiratory function.
• Relaxation.
• Care giver education.
• Postural Training.
• Balance training.
• Developing a exercise program focused for HD related impairments for the present and future.
Levels of Evidence for the Research

Levels are 1-9. Level 1 is the best level and level 9 is the worst level.

The Evidence of Exercise in Huntington’s Disease


• Level 8 Animal research model. (Low level)
• HD running mice demonstrated earlier motor symptom onset, but lifespan was the same.
• Running was voluntary on running wheel.
• Good take away from article is too much exercise in HD population could be counter-productive.
The Evidence of Exercise in Huntington’s Disease


• Level 4 Case Series. (Human Study)
• Investigated the effects of intensive rehabilitation programme on individuals affected by HD in early to mid stage of the disease.
• Patient’s admitted to rehabilitation for 3 weeks for 3 times a year over 2 years. Patient’s intensive regimen for 8 hours a day for Mon-Fri and 4 hours on Saturday. Sunday was rest day. Treatment intervention included respiratory exercises, speech therapy, physical and occupational therapy, and cognitive exercises.
• Patient’s demonstrated highly significant improvements of motor performance, daily life activities, and no motor declines over two years.
The Evidence of Exercise in Huntington’s Disease

- Level 6 Evidence. (Human Trail).
- 49 year old male with HD participated in a 14 week exercise program that consisted of exercises of balance, postural, coordination, flexibility, and gait training.
- Patient’s walking speed increased, balance scores improved, Unified Huntington’s Disease Rating Scale total motor score decreased, and disability score decreased.
The Evidence of Exercise in Huntington’s Disease

• Harrison DJ, Busse M, Openshaw R, Rosser AE, Dunnett SB, Brooks SP. Exercise Attenuates Neuropathology and has Greater Benefit on Cognitive than Motor Deficits in the R6/1 Huntington’s Disease Mouse Model. Experimental Neurology 2013; 248; 457-469.

• Level 8 Animal Model.

• Determined exercise improved walking and decreased the progression of cognitive dysfunction.
The Evidence of Exercise in Huntington’s Disease

- Level 4 Case Series. (Human Study)
- Participants played the Dance Dance Revolution game with supervision and the handheld game without supervision for 45 minutes, two days per week for six weeks.
- Mild balance improvements.
- Dance Dance Revolution appears to high compliance and motivation.
The Evidence of Exercise in Huntington’s Disease


- Identical twins in Finland who shared the same sports and other physical activities as youngsters but different exercise habits as adults soon developed quite different bodies and brains.

- Sedentary twins had lower endurance capacities, higher body fat percentages, and signs of insulin resistance, signaling the onset of metabolic problems.

- Twins’ brains also were unalike. The active twins had significantly more grey matter than the sedentary twins, especially in areas of the brain involved in motor control and coordination.
The Evidence of Exercise in Huntington’s Disease


- Program Design: Based on the literature, clinical expertise and patient values, the program was designed to include four key features:
  - (1) community-based group format for individuals with HD, caregivers, and those at-risk for HD
  - (2) individualized prescription within the group
  - (3) circuit training
  - (4) use of outcome measures
# The Evidence of Exercise in Huntington’s Disease


<table>
<thead>
<tr>
<th>Study</th>
<th>n</th>
<th>Sample</th>
<th>Intervention</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binswanger, 1980(^{[19]})</td>
<td>5</td>
<td>Outpatients</td>
<td>Home physiotherapy (focus: muscle weakness, range of movement, gait, breathing) 60 min twice a week for 4 weeks Weekly physiotherapy and occupational therapy</td>
<td>Objective outcome measurements not reported, subjective improvements in alertness and balance</td>
</tr>
<tr>
<td>Lavers, 1981(^{[20]})</td>
<td>6</td>
<td>Late-stage patients on a long-term care psychiatric ward</td>
<td>Weekly outpatient physical therapy program for 3 months (45 min), followed by three monthly sessions, designed to be done at home between therapy sessions with no assistance necessary</td>
<td>Objective outcome measurements not reported, 2 patients gained body weight</td>
</tr>
<tr>
<td>Peacock, 1987(^{[21]})</td>
<td>10</td>
<td>Early to mid-stage patients</td>
<td>Hydrotherapy (gentle exercises in water supervised by a physiotherapist(), unknown period</td>
<td>Objective outcome measurements not reported, “all patients improved”</td>
</tr>
<tr>
<td>Sheaff, 1990(^{[22]})</td>
<td>1</td>
<td>Case Report (severely disabled male)</td>
<td>Hydrotherapy (gentle exercises in water supervised by a physiotherapist(), unknown period</td>
<td>Objective outcome measurements not reported, “physiotherapy was beneficial”</td>
</tr>
</tbody>
</table>
# The Evidence of Exercise in Huntington’s Disease

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<th>Participants</th>
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<th>Outcomes</th>
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</thead>
<tbody>
<tr>
<td>Quinn &amp; Rao, 2002[^23]</td>
<td>1</td>
<td>Home program (physical therapy) for 14 weeks</td>
<td>Improvement of SF-36, number of falls, walking speed, Berg Balance Scale (+9), UHDRS-TMS (-12)</td>
</tr>
<tr>
<td>Bohlen et al., 2013[^24]</td>
<td>12</td>
<td>Physical therapy sessions, twice per week, 60 min for 6 weeks focusing on transfer training, walking, postural stability, motor coordination tasks</td>
<td>Significant improvement of gait parameters (GAITRite®), Timed-“up&amp;go”, Berg Balance Scale</td>
</tr>
<tr>
<td>Kloos et al., 2013<a href="RCT">^25</a></td>
<td>18</td>
<td>2 days per week 45 min “Dance Dance Revolution” for 6 weeks</td>
<td>Significant improvement of gait parameters (GAITRite®)</td>
</tr>
<tr>
<td>Khalil et al., 2013<a href="RCT">^26</a></td>
<td>25</td>
<td>Exercises at home three times a week for eight weeks using an exercise DVD</td>
<td>Significant improvement of gait speed, balance, function and level of physical activity</td>
</tr>
</tbody>
</table>

[^23]: Quinn & Rao, 2002
[^24]: Bohlen et al., 2013
[^25]: Kloos et al., 2013
[^26]: Khalil et al., 2013
## The Evidence of Exercise in Huntington’s Disease

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<td>Reyes et al., 2014</td>
<td>18</td>
<td>6 times a week home-based inspiratory and expiratory (each 5 sets of 5 repetitions) muscle training for 4 months</td>
<td>Significant improvement of maximum inspiratory/expiratory pressures, forced vital capacity, forced 1 s expiratory volume and peak expiratory flow</td>
</tr>
<tr>
<td>Quinn et al., 2014</td>
<td>30</td>
<td>Task-specific training by physical therapists in participants homes, focusing on walking, sit-to-stand transfers and standing, twice a week for 8 weeks</td>
<td>92% of individual goals were achieved</td>
</tr>
<tr>
<td>Metzler-Baddeley, 2014</td>
<td>10</td>
<td>1 preclinical, 9 early to advanced stages of HD</td>
<td>Improvements in executive functions, changes in white matter microstructures (genu of the corpus callosum)</td>
</tr>
<tr>
<td>Dawes et al., 2015</td>
<td>30</td>
<td>Once per week gym intervention with support from a physical therapist (20-30 min, stationary cycle), 10 min a day twice a week walking quickly</td>
<td>No adverse events, no significant influence on heart rate</td>
</tr>
</tbody>
</table>
# The Evidence of Exercise in Huntington’s Disease

**Studie** | n | Patienten-charakteristika | Intervention | Outcome |
--- | --- | --- | --- | --- |
Zinzi et al., 2007[38] | 40 | Early to mid-stage HD inpatients | Respiratory exercises, speech, physical and occupational therapy, cognitive exercise, three week inpatient rehabilitation (repeated up to 3 times per year) | Significant improvement of motor performance and ADL (p < 0.001), no motor decline over two years |
Thompson et al., 2013[39](RCT) | 20 | Early to mid-stage HD outpatients | Respiratory exercises, speech, physical and occupational therapy targeting cognitive deficits (6 months, 60 min per fortnight) and home exercises (6 months, 3 times per week) | Reduction of motor and postural stability deterioration, minor improvements in depression, cognition and quality of life |
Piira et al., 2013[40] | 37 | Early to mid-stage HD inpatients | 1 y rehabilitation program (3 admissions of 3 weeks each) focusing on physical exercise, social activities, and group/teaching sessions | Improvements in gait function, balance, physical quality of life, anxiety and depression, BMI; ADL-function remained stable with no significant decline |
Ciancarelli et al., 2013[41]; Ciancarelli et al., 2014[42] | 34 | HD inpatients (mean BI 77 points) | 3-week inpatient intensive multifunctional neurorehabilitation, 2 x 120 min group therapy daily (physical and occupational therapy) | Significant increase of the mean scores of BI, TS, PPT and TFCS (p < 0.001), reduction of oxidative stress, parameters of neurodegeneration (Cu/Zn-SOD, NSE) |
Cruickshank et al., 2015[43] | 15 | Outpatients, UHDRS-TMS > 5 | 9 months once-weekly supervised clinical exercise, thrice-weekly self-directed home based exercise and fortnightly occupational therapy | Significantly increased gray matter volume in the right caudate and bilaterally in the DLPFC, significant improvements in verbal learning and memory (Hopkins)
The Evidence of Exercise in Huntington’s Disease

• Balance, coordination, core stability, functional and task specific training, and ambulation and gait training.
• Each program was developed to span the 30 minute pool session and was progressed as necessary throughout the study.
• Improved mood and quality of life, safe and feasible, improved sleep, and it improved self-reported motor function (or physical conditioning).
Early Onset Stage of Huntington’s Disease Focus of Physical Therapy

• The stage at which the person is either diagnosed with motor and/or cognitive sign and symptoms. Very debatable on when the stage actually occurs.
• Gait and balance training to prevent falls in conjunction with Tetrabenazine (Xenazine) if needed.
• Aerobic capacity and strength training.
• Relaxation.
• Prescription of safety equipment if needed.
• Care giver education.
• Postural Training.
• Stair training.
Mid Stage of Huntington’s Disease
Focus of Physical Therapy

- Stage where person starts having difficulty with walking, transfers, stair climbing, and falls could start occurring. Keeping person mobile is the goal here. Usually when the person is referred to Physical Therapy.
- Gait and balance training to prevent falls in conjunction with Tetrabenazine (Xenazine) if needed.
- Relaxation.
- Prescription of safety equipment and Wheelchair prescription and training if needed
- Postural Training.
- Stair training and Environmental Altercations if needed
- Joint range of motion, Dystonia Management, Prevent of contractures.
- Respiratory function.
- Transfers/Mobility with care giver education
- Shorter bouts of exercise with more frequency to prevent stress overload.
The Evidence of Physical Therapy in Huntington’s Disease


- Determined Physical Therapy is underutilized in the early stages and Mid stage is when patient’s are referred to Physical Therapy.
Late Stage of Huntington’s Disease
Focus of Physical Therapy

• Stage at which the person has much difficulty getting out of bed, walking, and caring for themselves. Fall prevention is the main goal at this point.
• Protecting the patient.
• Relaxation.
• Environmental Altercations if needed
• Joint range of motion, Dystonia Management, Prevent of contractures.
• Respiratory function.
• Transfers/Mobility with care giver education
• Shorter bouts of exercise with more frequency to prevent stress overload.
3 Balance Systems

- Vestibular System: sensory receptors of the inner ear.

- Somatosensory System: sensory information from the skin, muscles, and joints.

- Visual System: sensory receptors in the retina are called rods and cones.
How the Physical Therapist Trains Canceling the Vestibular System

- Covering the ears.
- Headphones.
- Noise.
How the Physical Therapist Trains Canceling the Somatosensory System

• Uneven surface.

• Moving surface.
How the Physical Therapist Trains Canceling the Visual System

- Eye’s Closed.
- Blind Fold.
- Turn lights off.
Postural Training

• As HD progresses, postural muscle weaken.
• This includes trunk extensors, neck extensors, core muscles, hip extensors, knee extensors.
  *Poor posture is related to increased back pain.

• As the progression continues hand and feet muscles weaken.
Core and Postural Strengthening

- Scapular Retraction
- Wall Push-ups
Core and Postural Strengthening

- Sit-stand
- Planks and side planks
- Chin-tucks
Postural Stretching/ROM Focus for HD

- Doorway stretch for tight pecs
- Hip flexor stretch in standing, if person has enough balance or laying if balance is a concern.
Memory Training/Task Planning/Task Execution/Problem Solving with Apps

Personal Zen: the app about staying positive and reducing stress and anxiety.
Environment Enrichment Research

• Spires TL, Grote HE, Varshney NK, Cordery PM, Dellen AV, Blakemore C, and Hannan AJ. Environmental Enrichment Rescues Protein Deficits in a Mouse Model of Huntington’s Disease, Indicating a Possible Disease Mechanism.

• Used Environmental Enrichment, which mice were exposed to nontoxic objects placed in the home cage that were changed every 2 days. Objects consisted of small cardboard boxes, small open wooden boxes, cylindrical cardboard tunnels, and folded sheets of paper.

• Mice had delays in motor symptoms, increased brain weight, and rescues specific protein deficits.

• Maybe long walks on beaches/parks, site seeing, and etc maybe beneficial vs sedentary lifestyle.
Potter MC, Yuan C, Ottenritter C, Mughal M, Praag H. Exercise is not beneficial and may accelerate symptom onset in a mouse model of Huntington’s Disease. PLOF Currentts Huntington Disease. 2010 Dec 7, Edition 1


Harrison DJ, Busse M, Openshaw R, Rosser AE, Dunnett SB, Brooks SP. Exercise Attenuates Neuropathology and has Greater Benefit on Cognitive than Motor Deficits in the R6/1 Huntington’s Disease Mouse Model. Experimental Neurology 2013; 248; 457-469.


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Rollnik, J.D. Do Huntington’s Disease Patients Benefit From Multidisciplinary Inpatient Rehabilitation?(2015) Int J Neurol Brain Disord 2(1): 1- 5.