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|  | **Julianne Runey** |
|  | **Topic:** For patients with Parkinson’s Disease is the use of a boxing training intervention an effective treatment option to maintain function and quality of life.  | **Search**: PubMed, CINHAL, Cochrane |
| **Author/year** | **Purpose/ Design/ Subjects** | **Intervention** | **Measurements** | **Outcomes** | **Limitations/ Comments** |
| Rocha, P1/ 2015 | **Design:** Systematic review with meta-analysis**Purpose:** To evaluate the effects of complementary physical therapies on motor performance, quality of life, and falls in people living with PD**Subjects**: -N= 35 -20 RCTs -2 non-RCTs -13 case series studies-1210 total participants from included studies-13 studies had follow-up assessments-Mean age: 60.17 +/- 10.26 to 72.77 +/- 7.87Inclusion criteria:-Subjects had dx of PD-Interventions of ‘alternative’ PT-Dependent variables assessed (mobility, gait, balance, QofL, disease severity) | -‘alternative’ PT compared with no treatment-‘alternative’ PT compared with conventional PT-‘alternative’ PT compared with another ‘alternative’ method of PT | 1.Mobility (TUG, 5XSTS, Functional Reach Test)2.Balance (BBS, ABC Scale, MiniBest Test. Tinetti, Four Square step test)3.Gait (walking speed, step length, stride length, cadence, 10m Walk Test, 6min Walk test)4.Falls (Fall calendar, falls efficacy scale)5.ADLs (Bathel Index, UPDRS II)6.QofL (PDQ-39, SF-36, PDQL, Nottingham’s Scale)7.Disease Severity (UPDRS, UPDS III, UPDRS I) | Therapeutic effects of intervention:-Tia Chi= improved functional mobility, gait, disease severity, postural stability. Gains often maintained for 3 months. -Dance= improved functional mobility, QofL, gait, balance, disease severity. Increased enjoyment reported by patients and increased adherence. Improvements seen in 6minWT, BBS, and UPDRS III. -Aerobic training= improved functional mobility, ADL, balance and disease severity, walking improvements-Boxing training= could improve functional mobility, ADL, gait, and balance.-The use of dance, water exercises, virtual reality training, and Nordic walking help improve ease of movement, health, and wellbeing.-Remains uncertain the long-term benefits of boxing training and other alternative interventions. | -Only one case series study regarding boxing training was included in this SR.-From a methodological perspective, the evidence available regarding the use of complementary therapies is of moderate strength-Further research is needed to determine if boxing training and other alternative PT options produce long term benefits for those with PD. |
| Combs, S2 / 2011 | **Design:** Case series**Purpose:** Describe the effects of disease severity and duration of boxing training on changes in balance, mobility, and quality of life for patients with mild or moderate to severe PD. **Subjects:** -N=7  -dropouts: N=1 -Included in study: N=6-dx with PD, interested and new to boxing training and the Rock Steady Boxing Foundation-age range: 51-77 y.o.-currently not receiving PT, able to ambulate independently, able to follow at least 3-step verbal commands, no additional preexisting neurological conditions, current MSK or cardiovascular conditions, pregnant, brain surgery, or implantation of deep brain stimulator. | - 12 weeks of the boxing training program with the Rock Steady Boxing Foundation. Intervention performed by professional boxers who were certified athletic trainers-attended 24-36 boxing sessions during time frame-20 minute warm up of breathing and stretching -45-60 minute circuit training: function, endurance, and punching activities -alternate through with 3 minutes of training and 1 minute rest break -functional training= whole body fitness activities-endurance activities= walking, running, cycling-punching activites= heavy bag, speed bag, focus mitts-End with 15-20 minute cool down of core stretching and strengthening and breathing exercises. |  - Testing was taken 1 week before beginning training and 1 week after the intervention.- Follow up testing performed after the intervention at 24 weeks and 36 weeks regardless of whether participant continued training.**Balance**-Functional Reach Test (FRT)-Berg Balance Scale (BBS)-Activities-specific balance confidence scale (ABC)**Gait and mobility:**-Timed up and go (TUG)-6min walk test (6MWT) | **Balance**-FRT: all pts increased distance reached by 24-wks. Mod-severe PD consistently increased reaching distance thru case series (2 pts exceeded MIDC at 36-wk test) while those with mild PD showed small increase over time (1 pt exceeded MDIC at 12-wk test)- BBS= all pts maintained or increased score at 12-wk and 24-wk test. 5/6 pts maintain or improved score at 36-wk test.-ABC= 5 out of 6 pts maintained or increased score at 24 and 36 wk tests. Mod-severe PD pts showed consistent improvements during course Pt with mild PD showed little change in balance confidence over time. **Gait and mobility**-TUG= Five pts decreased time of TUG at 12 and 24 wk test. Six pts decreased time of TUG at 36 wk test. Mild PD pt showed decease in time > 10% from baseline at 12-wk test; not seen consistently by those with mod-severe PD until 24-wk test-6MWT= 5 pt increased distance walked at 12 and 24 wk testing; All pts (n=6) increased walking distance at 36 wk test. | -Pts with mod-severe PD demonstrated consistent improvement in all balance tests, while those with mild PD improvements were present but not as prevalent.- Greater and earlier improvements in gait were seen for those with mild PD.-Balance confidence slightly improved for those with mild PD compared to those with mod-severe PD who demonstrated a more significant improvement in balance confidence. -Immediate and long-term improvements in balance, mobility, endurance, and QofL across all severities.-Boxing training is feasible for all patients regarding the level of PD severity |
| Combs,S3/2013 | **Design:** RCT**Purpose:** Compare group boxing training to traditional group exercise on function and QofL for those with PD**Subjects:**-N=31Boxing: n=17Exercise: n=17Inclusion:-reported dx of PD->21 y/o- currently not receiving PT- Independent ambulatory in home with or without AD- able to follow at least 3 step commandsExclusion:-other neurological conditions besides PD-current MSK or cardiovascular conditions impairing participation | - All participants attended 24-36 sessions each 90 minutes long over 12 weeks.-Boxing training led by 1 of 2 personal trainers -Traditional exercise lead by 2 PT students under supervision of licensed PT**Boxing Training**-stretching -Boxing: lateral foot work, punching bags-resistance exercises-aerobic training- see Combs 2011 for more details**Traditional exercise**:- Warm-up 15 minutes with stretching and seated exercise-60 minutes of: resistance exercise aerobic training balance activities-15 minute seated cool down similar to warm up-dumbbells of self-selected weight (5-8lbs) and body weight was used for resistance -balance activities varied from static to dynamic standing, various BOS, and visual input -Exercises= reaching, standing on discs or rocker boards, negotiating obstacle courses | Measures taken prior to intervention and after completion of 12 wks.-Assess balance, balance confidence, mobility, gait velocity, gait endurance, QofL-Berg, ABC, TUG, dTUG, 6MWT, PDQL | -The exercise group perceived a greater improvement in balance confidence with statistical significance found between groups on the ABC. Between group effect size= 0.97 -After training, Boxing group demonstrated statistically significant increase in median distance walked while exercise group decreased distance in 6MWT. -Only Boxing group had statistically significant improvements on gait velocity and endurance (6MWT); no between group significance found.-Both groups showed improvements in balance (Berg), mobility (TUG, dTUG), and QofL (PDQL) -5 participants of each group exceeded MDC for dTUG showing improvements in dual cognitive and motor tasks.  | -High dropout rate of 9 participants (3 from the exercise group and 6 from boxing group); an additional 2 participants did not complete the minimum of 24 sessions in the time frame.-Balance activities in the traditional group allowed pt to recognize activities that address balance and were more familiar with activities when tested during performance of outcome measures.-Intensity of Boxing training in this study may have assisted in improving endurance over the self-paced exercise group.Improvements were seen in both groups (except balance confidence/ABC) indicating that the boxing training can help improve function and QofL in the PD population. |
| King,L4/2009 | **Design:** Perspective study: sensorimotor agility program for mobility in Pt with PD**Purpose:** Develop a conceptual framework to design exercises aimed to delay disability and maintain or improve mobility in patients with PD.**Evaluators:** internationally recognized neurologists specializing in movement disorders for more than 35 years and 5 PTs ( 3 with PhD) focusing on PD, 6 certified athletic trainers | -discuss PD constraints on mobility-Agility exercise program with progressions-progressions for boxing training-exercise program for 60 min with 10 min of each category of exercise in table below. (table 2) | **Constraints affecting mobility and exercise principles**- see table below (Table 1)- **Rigidity**- increased co-contraction; reduced trunk rotation, decreased joint ROM, flexed trunk, increased axial tone**- Bradykinesia-** rehab should focus on increasing speed, amplitude, and temporal pacing of self-initiated movements to influence decreased arm swing, narrow BOS, slow and small movements.**-Freezing-** difficulty in shifting attention, preplanning movement strategies, or quickly selecting correct central motor programs**-Inflexible program selection**- difficulty with quickly switching motor programs; inability to change postural response synergies; impaired coordination associated with postural impairments during movements **-Impaired sensory integration**inability to detect rotation/movement of surface or passive rotation of torso; impaired perception of UE position and movements (associated with bradykinesia and dependence of visual system)**-Reduced executive function and attention**- difficulty with dual task and sequencing actions | **-**basal ganglia affects balance and gait by contributing to automaticity, self-initiated gait, and postural transition.**Drive Neuroplasticity with Task-Specific Agility Exercise**:**Reduce Mobility Constraints with Exercise**-muscle weakness, secondary to abnormal muscle activation is associated w/ bradykinesia and rigidity which can be present at all stages of PD**Bradykinesia=** exercise that promotes weight-shift control and postural adjustments in anticipation of voluntary movements (quick boxing movements); large protective steps outside of limits of stability and in response to external displacement (punching the bag); “think big” increase speed and amplitude of movements**Poor sequential coordination**= incorporate boxing actions into a remembered sequence to practice quick selection and sequencing of complex motor programs for mobility**Sensory integration**= external feedback and sensory cueing about quality and size of movement initially and decrease feedback/cueing as patient progresses; practice agility exercises with reduced ability to rely on vision (sunglasses, head turns, etc.)**Cognitive**= dual task, sequencing actions | - agility exercise increases trunk flexibility - exercise program with reciprocal movements (minimize agonist-antagonist mm co-contraction), axial rotation, increase flexibility of flexor muscles, strengthen extensor muscles- to reduce freezing, agility exercise should be used in environments where freezing typically occurs during early stages of PD (high stepping, large step tasks)-Poor proprioception and sense of position (poor kinesthesia and sensory integration) seen in pts with PD.Category IV (boxing) focuses on building agility and speed, backwards walking, and components of anticipatory and reactive postural adjustments |
| King,L5/2013 | **Design:** Randomized single blinded intervention study**Purpose:** Determine which outcome measures were sensitive to exercise intervention and explore effects of Agility exercise programs compared to treadmill training for improving mobility with PD.**Subjects:** -N=39-Agility Boot Camp(ABC)n=20-Treadmill Training (TT): n=19-Dx idiopathic PD-Tx with levodopa-age: 45-85-willing and able to come to clinic 4x/wk for 4 wksExclusion criteria:-unable to ambulate unassisted-additional neuro, cardiovascular, or orthopedic problems effecting mobility-cognitive impairments limiting participation | -All participants assigned to 16 tx sessions for 75 minutes each.-Tx= 4x/wk for 4 consecutive wks under PT. -Measurements taken at baseline and after completion of intervention **Agility Boot Camp**:-circuit training of 6 activities: (1)pre-Pilates (2) kayaking (3)tai chi (4) boxing (5)lunges (6) agility-10 minutes of each activity with rest as needed and progressions as tolerated-Progressions: (1) sensory integration (2)dual cognitive task(3)limiting external cues(4)increasing speed and resistance**Treadmill Training**:-fast walking on treadmill for 30-45 minutes as tolerated-intensity started at 80% of participants natural gait speed and increased to 90% at week 2 | **Participation**-PDQ-36= changes in participation level-ABC=QofL-UPDRS Part II= assess ALDs**Activity:** assess changes in balance mobility, and disease severity-Mini-BESTest-Berg-UPDS Part III**Body Structures and Function**-ITUG= gait and turning assessment-ISway= balance during static standing | - Greatest improvements seen at the body structure and function level of ICF after exercise intervention- differences between groups were not able to be directly compared due to underpowered- But, trends suggest that more outcome measures improved after ABC rather than TT.- Postural sway was the only measure considered sensitive with a decrease seen after ABC. | -study grouped all participants together to determine which measures were more responsive to create a higher power, meaning the study was under powered.-Study suggests that the reason different exercise interventions have not been proven more effective than others is secondary to insensitive outcome measures and/or underpowered studies. |
| King,L6/2015 | **Design:** RCT **Purpose:** Compare success of exercise when administered by HEP, individualized PT, or a group class.**Subjects:** **-**N=58recruited from the Movement Disorders Clinic at Oregon Health Sciences University (OHSU) and the local communityInclusion:-Dx of idiopathic PD-age: 40-80 y/o-have at least 1 comorbidity associated with PD or aging-walk unassistedExclusion:-require assistance for ADLS-engage in >10 hrs of exercise/wk-lack transportation to OHSU 3x/wk | - The study was designed in waves of n=12 with 4 people in each group.-Intervention took place over 6 wks with 4 wks of exercise interventions (3x/wk for 60 minutes) and 1 wk for pre-testing and 1 wk for post testing**Exercise intervention****-**sensorimotor ABC program (same as King,L/2013)-Each program was designed to incorporate the exercise interventions for the same time frames but in various settings**HEP**= met with PT once to receive ABC program and therapist assigned an appropriate exercise intensity/progression based on participant’s safety to be able to perform program at home.**Individualized**= met one-on-one with PT 3x/wk for 1 hr in outpatient setting. Progressions were made when appropriate.**Group**= participants met at wellness center 3x/wk for 1 hr. PT lead class and progressed participants as appropriate.  | **PPT**= assess common tasks/ ADLs **Mini-BESTest**= balance**TUG**= mobility **TUG-d**= dual task, mobility, cognition**PDQ-39**= QofL**ABC**= confidence in balance | **-Individual:** only group to improve on PPT; showed greatest improvements in functional measures (PPT, apathy, self-efficacy, depression, balance)**-Group:** most improvements in gait measures of freezing, velocity, arm swing, trunk movement, gait variables**-Home:** improved the least across all outcomes. | -HEP, which are a standard of care for PD, are the least effective method to improve mobility-Individual treatment allows for better improvements in balance and functional measures- Improvements seen in gait characteristics following group exercise classes. |
| Farley, B7/ 2005 | **Design:** Double blinded RCT**Purpose:**To assess the generalized training of large amplitude movements involving the whole-body and the impact on amplitude and speed of functional upper and lower limb tasks for both the preferred and as fast as possible speed conditions. **Subjects:*** N=18
* Stage I: n=6
* Stage II: n=7
* Stage III: n=5
* Dx of PD
* Volunteer and signed informed consent
* No medical complications that would interfere with movements
* Never participated in LSVT
* No additional PT, OT, or weight training while participating in study

Control group: untreated PD group | -Amplitude-based intervention (Training BIG)-Provided by PT blinded to data collection-One hour session 4x/wk, for 4 wks.- Sessions included: BIG stretches, repetitive multidirectional BIG movements, and amplitude drills -All activities were done with multiple repetitions (at least 10) and stretches were held for a minimum of 10 seconds.- instructions for speed of movements given varying between preferred condition (every day way of performing task) and as fast as possible.- practice trials (3-7) allowed prior to testing- Data computed through average of 2 trials for reaching distance and speed. –Data computed through average of 2-3 trails for each gait condition. | -All measures were taken the week before the intervention and the week after training**Reaching tasks** at arm’s length (AL), 10 cm shorter than AL, and 10 cm longer than AL:- distance reached at preferred velocity-distance reached at as fast as possible velocity-speed-distance relationship measured through wrist velocity**Gait task**:- velocity, stride length, and cadence -measured at preferred velocity and at as fast as possible velocity.**Hoehn and Yahr category and velocity changes:** Assess training BIG effects based on level of disease severity while performing task at preferred velocity.  | **Wrist velocity:**-Preferred speed: Intervention group saw an increase in wrist velocity following intervention at all reaching distances.-Significant increases seen at distance of AL and AL + 10 cm with an avg velocity increase of 14% following intervention compared to only 5% increase for control group.-Fast as possible: significant increase in wrist velocity seen only at the longest (AL+10cm) distance by 16% after intervention compared to only a 5% increase in the control.**Gait**-Preferred speed: increase in gait velocity through increased stride length following intervention. No change in cadence seen. A 12% increase in preferred gait velocity compared to the controls 4% increase.-Fast as possible: Intervention group saw an increase in stride length/ amplitude resulting in slight increase in gait velocity and decrease in cadence compared to untreated control.-Subjects took larger steps without majorly changing velocity or cadence- possible ceiling effect for velocity.**Disease severity and velocity changes**: -Reaching at AL+10cm: substantial improvements seen for all stages with greater gains seen in those with milder impairments (Stage I).-Gait velocity: inverse relationship of degree of improvement and disease severity. Substantial improvements seen in gait velocity for those of Stage I but those of Stage III were not able to spontaneously increase gait velocity. | - Training at larger amplitudes results in faster limb movements and decreases bradykinesia.-Improved velocity seen at preferred task speeds after intervention for both reaching and gait. -Greatest improvements seen at longest distances for reaching and with increased stride length with gait. -Increasing speed and velocity of movements is more difficult with increased severity of PD |

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