The Effect of a Single Non-Contact Boxing Training Session on Anticipatory Postural Adjustment in Parkinson's Disease.

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Background

- Parkinson's disease (PD) is characterized by tremors, rigidity, bradykinesia, and postural instability.
- Older adults and people with PD have abnormal Anticipatory Postural Responses (APA), both in onset and scale.
- Previous research has shown that medicine ball training for 30-minutes significantly altered APAs.
- Many individuals with PD report improved balance, gait, and activities of daily living from non-contact boxing (NCB) also called "Parkinson's Punch."

Purpose

- To identify the effects a single 30-minute session of NCB has on APAs in participants with Parkinson's disease.

Methods

- One group pretest-posttest design
- 18 individuals with PD (H&Y Stage III or less); mean age of 68.5 (±5.0) (Table 1)
- APA inducing activities included:
  - Cued bilateral arm lift (BAL)
  - Self-paced BAL
- Participants performed non-contact boxing for a single 30 minute session (Table 2)
- **Measures of interest included:**
  - **Kinematics:** Video analysis of ankle excursion and latency
  - **Kinetics:** Force plate for peak force of COP and time to peak force
  - **Surface EMG:** Onset of lateral gastrocnemius and anterior deltoid (LG/AD) muscle contraction
  - **Angular Velocity:** Arm angular velocity using ErgoMeter™
- Paired t-tests compared LG/AD latencies, EMG, kinetics, kinematics, and angular velocity data before and after boxing exercises, and boxers vs nonboxers.

Results

Kinematics Latency and Ankle ROM: Both conditions improved latency/ROM between pre and post exercise. Only latency during cued BAL was significant (*p=0.001)*.

Kinetics: No significant changes when analyzing peak force of COP and time to peak force data.

Surface EMG: LG/AD latency and onset of activation were insignificant but improved. (Figure 1)

Angular Velocity: Significant differences were found for cued BAL 50th percentile (t = -2.30(17), *p = 0.035*; post mean = 2.40, pre mean = 2.86) (Figure 2)

H&Y Comparison: H&Y 1-1.5 had shorter latency from pre/post exercise; H&Y 2-2.5 had incorrect sequencing of firing on average pre-trial (AD prior to LG), sequence reversed post- exercise (LG prior to AD)

Boxing Experience Comparison: Current NC boxers had a statistically significant improvements in LG/AD latency post-exercise for the cued BAL condition. (t= -3.012(4), *p= 0.039)*.

Demographic	Mean (SD)	Freq (%)
Age	68.5(5.0)	-
Height (in)	67.8(3.6)	-
Weight (lbs)	168.5(39.5)	-
Years Since Diagnosis	6.6(3.3)	-
UPDRS	20.3(7.1)	-
Sex		
Male	-	9(50)
Female	-	9(50)
Activity Level		
<3/wk	-	2(11)
3-5/wk	-	6(33)
Daily	-	10(55)
H&Y		
1&1.5	-	6(33)
2&2.5	-	11(61)
3	-	1(6)
Hx of boxing		
No, never	-	7(39)
Previous >6 mo	-	4(22)
Yes, current	-	7(39)

Table 1. Subject demographics

Boxing	Footwork	Ball toss
Static Alternating Forward punches	Round swing with steps	Medicine ball pass and shuffle
Combo: 2 forward punches + 1 uppercut	Speed Ladder Forward	Ball toss on on toes
Grapevine + 2 side punches	Speed Ladder Sideways	Rotational side throws
Gallop and Combo punch	Under-theraband punch	
Box square with punches rotating one way	High knees	
Gallop and punch	Grape Vines	
Bob + Weave		
Box square with punches walking		**Active Rest:** Air boxing

Table 2. 30 minute NCB routine performed as intervention for each subject

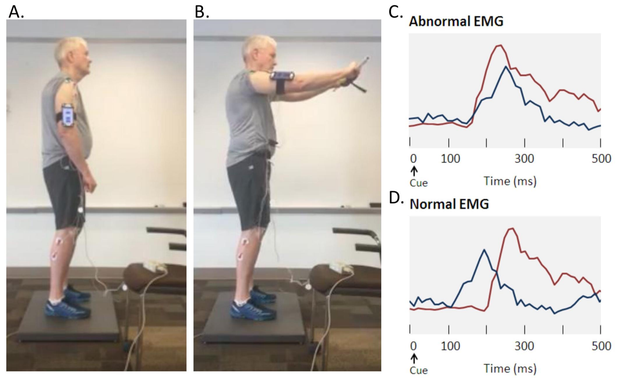


Figure 1. (A) Starting position for the BAL motion. (B) Ending position for BAL motion. (C) Abnormal EMG tracings for AD (red) and LG (blue) muscles during the cued BAL. (D) Normal EMG tracings for AD (red) and LG (blue) muscles during the cued BAL.

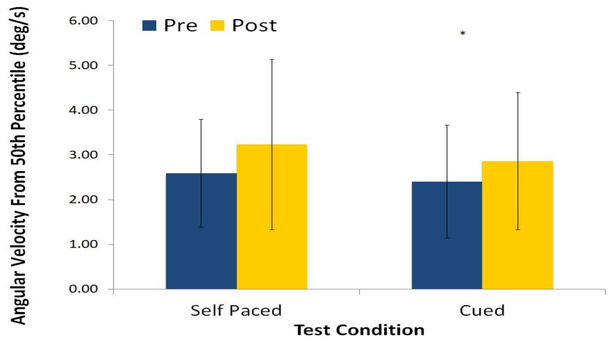


Figure 2. Arm angular velocity (deg/s) from the 50th percentile measurement before and after intervention. * Significant angular velocity (pre,post) cued BAL condition.

Conclusions

- Both conditions improved latency suggesting timing of LG/AD is capable of changing with participation in NCB.
- Improved angular velocity of the arm (cued cond) suggests improved ability to generate force while maintaining postural stability.
- One session of NCB benefits those with lower H&Y scores, demonstrated by improved EMG latencies.
- One session of NCB promotes proper sequencing of LG/AD in those with moderate H&Y scores, allowing for better APA responses.
- Current boxers showed significant improvements in LG/AD latency following NCB, indicating participants without boxing experience may improve latency with continued NCB sessions.
- Overall, one session of NCB demonstrated changes in kinematics, kinetics, and EMG indicating that it may be beneficial for APA production, even though some of the data is not significant.
- Further research is needed to determine if long term NCB participation can significantly alter APA response in adults with PD.

Clinical Relevance

- NCB alters latency, moving onset of deltoid closer to gastroc activation therefore improving balance reactions under cued conditions.
- Components of NCB promote a more appropriate APA response.
- Auditory cues can influence movement in patients with PD.
- Continued exercise for balance improvement is important in those with PD.