

THE UTILITY OF A MULTIDIRECTIONAL SUBMAXIMAL EXERTIONAL STEP AS PART OF AN EXERTIONAL REHABILITATION PROTOCOL AFTER CONCUSSION

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Background

Exertional Rehabilitation: a graded exertional protocol of aerobic exercise

5-Step Protocol: ranges from 1-light exercise to 5-multi-directional function movements at high intensity intervals

Step 5: final step in the exertional rehabilitation protocol involving a dynamic multidirectional high intensity interval (HIIT) exercise challenge

King Devick Testing (KD): measures visual/cognitive impairment through the reading of single-digit numbers on three test cards while testing for speed

Force Plate Balance Testing (FP): a device that measures balance, gait, and vestibular sense through single and double leg stances

Hypothesis

To investigate if Step 5 in the exertion protocol demonstrates statistical evidence of its clinical utility in determining return to dynamic exercise, return to sport, and full concussion recovery.

Methods

- Retrospective Chart Review
- N= 60 step 5 attempts
- Visits occurred between Jun2019-Jun2020
- All subjects were <21 y/o
- Tolerance of Step 5 was determined by a clinic concussion specialist

Testing:

- Step 5 Exercise Tolerance
 - Determined by monitoring onset of symptoms/signs and cardiovagal autonomic assessment including post exertion orthostatics
- Pre/Post KD
 - Compared KD times before and immediately after Step 5 exercise cool down
 - Significant change= slower by ≥ 2 seconds in 2 or more cards post exertion
- Pre/Post FP
 - Compared prior balance to post Step 5 balance on force plate using modified BESS protocols
 - Significant change= ≥ 0.2 deg/sec sway velocity post exertion

Results

Figure 1: Breakdown of Failed Step 5 Attempts by Reason

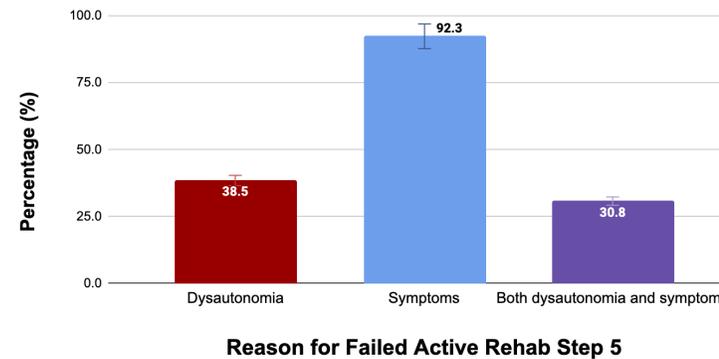
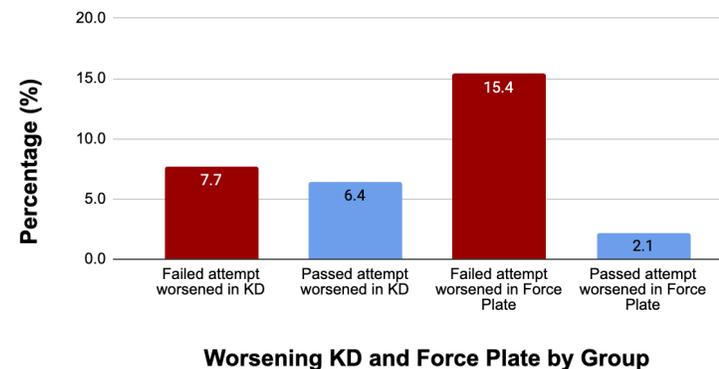


Figure 2: Percentage of Passed and Failed Active Rehab Step 5 Attempts with Worsening KD and Force Plate



Discussion

Failed Attempt Results:

- 21.7% failed Step 5 attempts
- 92.35% failed due to the onset of signs/symptoms
- 38.5% demonstrated dysautonomia

KD and FP Results:

- FP scores significantly worsened by >0.2 deg/sec 15.4% of the time in failed attempts
- The pass group only showed a significantly worse FP score 2.1% of the time
- KD scores did not show a significant difference in pre/post scores when comparing pass and fail groups, but the pass group had overall better scores and outcomes

Limitations

- Minimal data on utility of dynamic HIIT exercise testing post concussion currently exists
- Testing was completed at one clinic
- Small pediatric pilot sample size

References

1) Leddy JJ, Haider MN, Ellis MJ, Mannix R, Darling SR, Freitas MS, Suffoletto HN, Leiter J, Cordingley DM, Willer B. Early Subthreshold Aerobic Exercise for Sport-Related rehabilitation for slow-to-recover sport-related concussion in children and adolescents: further evidence to support its effectiveness. *BJSM*, 2013. Concussion: A Randomized Clinical Trial. *JAMA Pediatr*. 2019 Apr 1;173(4):319-325.

2) Gagnon et al. Another look at active rehabilitation for slow-to-recover sport-related concussion in children and adolescents: further evidence to support its effectiveness. *BJSM*, 2013.