

# The effects a Bal-A-Vis-X intervention on motor skills, particularly coordination and balance, in typically developing school-aged children.

D. Fay, PT, DPT, PhD, PCS; S. Cardenas, PT, DPT; T. Koivuniemi-Berg, PT, DPT; S. Werkau, PT, DPT

Physical Therapy Department, A.T. Still University, Mesa, AZ

## BACKGROUND

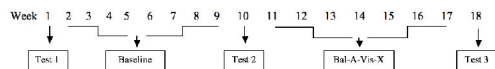
Coordination and balance are key aspects to motor skill development in young children and predict participation in play and physical activity throughout development. Ball skills and coordination exercise programs have previously resulted in positive changes in coordination skills on standardized assessments in school-aged children. Bal-A-Vis-X (BAVX) is a program that proposes to improve coordination and attention. BAVX consists of balance, auditory, and vision exercises, using balls or bags which are thrown or bounced to a steady rhythm while requiring mid-line crossings, visual tracking, coordinated timing, and bilateral integration. Although studies report positive changes in coordination with interventions related to several of the components within this program, the effect of a BAVX program on coordination has not been investigated.

## PURPOSE

The purpose of this study was to investigate the effect of a short-term BAVX intervention on the balance and coordination abilities of typical, school-aged children. Based on previous findings in the literature, we believed incorporating balance, auditory, and visual senses into exercise through a BAVX program would lead to a difference in coordination and balance between the baseline and intervention period.

## METHODS

This study was a quasi-experimental design involving a cohort sample with pre and post-tests administered before and after baseline and intervention phases.



### Participants:

- Participants included typically developing children between the ages of 4 and 12 years of age attending a local day care center.
- Participants had no previously diagnosed motor delays, were English speaking, and were able to follow directions.



### Procedure:

- All children were tested at weeks 1, 10, and 18. Testing was video taped to insure accuracy when grading.
- During the baseline phase, the children engaged in their regular school and extracurricular activities.
- During the intervention phase, each child participated in a BAVX intervention class for 30-45 minutes twice a week. Skills were progressed over the 7-week intervention based on accuracy of performance and the BAVX protocol.

### Measurement Tools:

- The Movement Assessment Battery for Children (MABC-2) and the Bilateral and Manual Coordination Composites of the Bruininks-Oseretsky Test of Motor Proficiency (BOT-2) were used to assess balance and coordination skills.
- An Activity Enjoyment Questionnaire was completed during week 18, with each participant rating aspects of the intervention on a Likert scale of 1 to 5.

### Data Analysis:

- Assessments were scored according to the procedures of the testing manuals.
- Friedman's tests were used to compare scores across testing sessions with Wilcoxon Signed Rank tests used for post-hoc analysis. Alpha level was set at .05 for all analyses.

## RESULTS

No significant differences were found between baseline and the intervention phase for the manual dexterity ( $p=0.51$ ), upper limb coordination ( $p=0.67$ ), and balance ( $p=0.56$ ) subtests of the BOT-2. The bilateral coordination subtest of the BOT-2 was significant at 0.04, but post-hoc analysis revealed the difference occurred during the baseline phase ( $p=0.01$ ). Findings on the MABC-2 were also not significant between baseline and the intervention phase for manual dexterity ( $p=0.67$ ), aiming & catching ( $p=0.91$ ), and balance ( $p=0.26$ ).

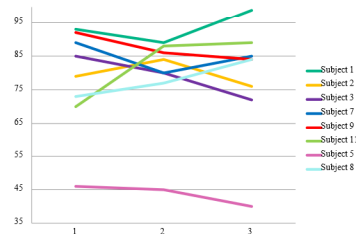
### Mean and Standard Deviation Scores

Movement ABC-2	Testing 1 (Week 1)	Testing 2 (Week 10)	Testing 3 (Week 18)
Manual dexterity	9.75 (3.37)	8.75 (3.41)	9.63 (3.25)
Aiming and Catching	10.13 (2.23)	10.63 (2.13)	10.75 (2.71)
Balance	10.50 (3.59)	11.50 (3.21)	10.75 (3.33)
Total Composite	10.13 (3.18)	10.00 (2.67)	10.13 (3.72)

BOT-2	Testing 1 (Week 1)	Testing 2 (Week 10)	Testing 3 (Week 18)
Manual dexterity	12.65 (4.53)	12.13 (5.08)	13.63 (4.72)
Upper limb coordination	15.13 (4.49)	16.63 (4.72)	16.88 (3.60)
Bilateral coordination	18.50 (2.78)	17.38 (3.20)	18.63 (2.77)
Balance	12.00 (2.83)	14.25 (6.18)	12.00 (4.38)

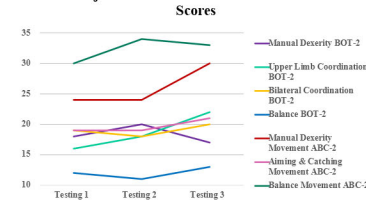
Some variability in response to the intervention was noted across subjects, but overall no significant changes were seen. Participant scores for the MABC-2 across the three testing times can be seen below.

### Movement ABC-2: Total Score



Changes in scores on the BOT-2 and MABC-2 for one participant, #8, can be seen in the figure below. This figure represents typical findings across all participants:

### Subject 8: BOT-2 and Movement ABC-2



Median ratings on the Activity Enjoyment Questionnaire indicated that the participants loved the activity, thought it was "pretty easy", and felt more coordinated after participating. Most participants' favorite activity was the 2x2 pattern with the balls. The least favorite activity overall was using the bean bags.

## DISCUSSION/CONCLUSIONS

BAVX did not result in significant changes in balance or coordination after a 7-week intervention program. These findings are not consistent with previous research on other coordination interventions, but differences in duration and type of intervention may be relevant. Westendorp et. al. (2014) found positive changes in coordination with similar tasks, including a progressive ball skill intervention, but they had subjects with learning disorders, a larger sample size, and a longer duration (16 weeks). Yasumitsu et. al (2013) found positive changes in coordination with a program of similar frequency (1-3 times per week) and duration to this study, but used exercises involving running and changing directions.

Challenges experienced in delivery of the intervention may also help explain the findings. Although the children reported that they enjoyed the intervention and felt they improved, the researchers noted that the format of the BAVX classes may not have been conducive to the best learning environment:

- Participants arrived at different times during the intervention classes due to differing school release times, making consistent lesson plans difficult.
- Weekly exposure was concentrated in 1-2 sessions, making some sessions too long.
- Participants' focus varied, based on their interest in individual activities, and this was difficult to accommodate in the group setting.
- Significant time was required to learn and practice techniques, challenging attention and focus for some children.
- Partners paired with children of different skill levels led to participant frustration.

The researchers employed several strategies to help maintain participant focus and would recommend these for future interventions:

- Using a "warm-up" prior to intervention to promote transition into activities
- Taking turns having one participant demonstrate in front of the whole group
- Giving them a number to focus on (i.e. let's see if we can do 5 in a row!)
- Working in smaller groups within the session

Prior to concluding that BAVX does not affect balance and coordination levels, the researchers suggest that further studies be done, looking at shorter interventions offered more frequently (15 minute sessions 3-5 x/week) over a longer period of time. Additionally, the children in this study all performed at expected age level on coordination tests and may have been limited in improvement by natural developmental levels. Previous researchers also noted that the 7-10 year age band on the MABC-2 may be measuring different motor skill constructs than the BOT-2, so further exploration of appropriate outcome measures in this area is needed. Finally, the researchers suggest that further studies be conducted to investigate the effect of BAVX in children with coordination deficits.

## ACKNOWLEDGEMENTS

The authors would like to acknowledge and thank the local daycare center for use of their facilities, the children who participated in the study for their time and cooperation, and the children's families for working with our intervention schedule.