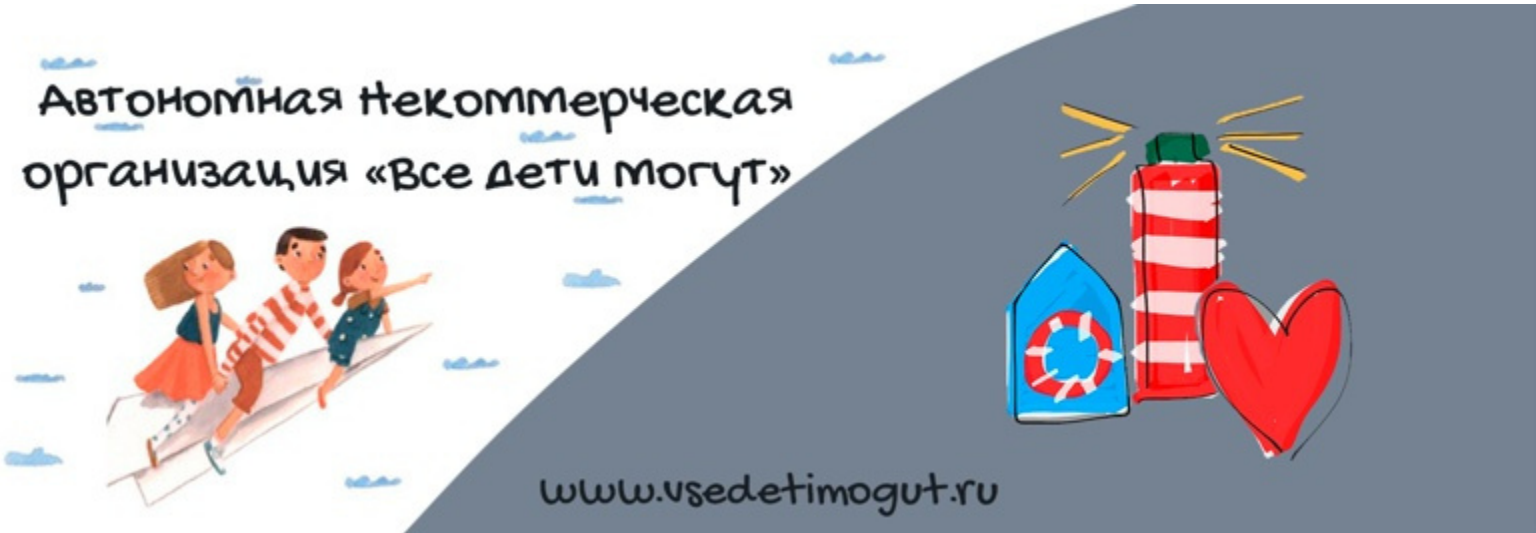
Терапевтические мячи и учащиеся с проблемами внимания и гиперактивности: влияние на выполнение задания и поведение во время сидения



Stability Balls and Students With Attention and Hyperactivity Concerns: Implications for On-Task and In-Seat Behavior

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KEY WORDS
- attention
- attention deficit disorder with hyperactivity
- behavior control
- interior design and furnishings
- task performance and analysis

We evaluated the effects of stability balls on in-seat and on-task behavior of students with attention and hyperactivity concerns. A group of 8 students in the 4th and 5th grades was observed 3 times/wk for 12 wk using a single-subject A–B continuous time-series design. We analyzed data collected from standardized measures and classroom observations for mean differences across pre- and postintervention phases. Results of the stability ball intervention revealed increased levels of attention, decreased levels of hyperactivity, and increased time on task and in seat or on ball. Findings from the social validity questionnaire demonstrated that teachers preferred the stability balls over chairs. This study provides additional evidence for the effectiveness of stability balls in the general education classroom for children who exhibit difficulties with attention and hyperactivity.

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Hallmark characteristics associated with attention deficit hyperactivity disorder (ADHD) include difficulties sustaining attention, impairment of self-regulatory behavior, and hyperactivity (American Psychiatric Association, 2000). These difficulties often translate into educational, social, and behavioral problems for many children diagnosed with ADHD (Loe & Feldman, 2007; Massetti et al., 2007). Students with ADHD typically score significantly lower on academic achievement tests (DuPaul et al., 2006; Loe & Feldman, 2007) and are more likely to suffer disciplinary infractions and to repeat a grade (Barkley, 2006). Moreover, students with ADHD experience these educational impairments throughout the course of their schooling, compounding the severity of their difficulties throughout their education (Massetti et al., 2007).

Although various treatments exist for children who exhibit characteristics of ADHD, psychopharmacological and behavioral management treatments have not been shown to affect academic or educational outcomes over the long term (Fischer, Barkley, Smallish, & Fletcher, 2002; Hechtman & Greenfield, 2003; Mannuzza, Klein, Bessler, Malloy, & LaPadula, 1993). Research evaluating whether children who display primarily inattentive symptoms fare worse than children who are also hyperactive has shown inconsistent results because both types show maladaptive outcomes over time (Loe & Feldman, 2007). Children with ADHD symptomatology therefore continue to show many adverse outcomes through adulthood, despite receiving treatment from an early age. Yet, many academic skills are important for success as an adult (Wirt et al., 2004), and intervening early with students who exhibit academic difficulties to alter the trajectory of academic failure is critical (Alexander, Entwisle, & Dauber, 1993; Entwisle, Alexander, & Steffel Olson, 2005).

One such intervention for increasing students' focus, enhancing levels of attention, and in turn improving academic achievement has been the

integration of stability balls in lieu of chairs in the classroom (Carriere, 1998; Schilling, Washington, Billingsley, & Deitz, 2003). In addition to the positive social validity of using stability balls for children with attention and hyperactivity concerns, several behavioral advantages have been found. Teachers have reported that students are more attentive, have higher achievement outcomes, and are better able to concentrate than when seated on chairs (Bill, 2008). Despite the overwhelming favor for using stability balls in the classroom, much of the evidence investigating the effectiveness of stability balls on students' levels of attention and overall behavior in the classroom has been anecdotal. In fact, only one study has systematically investigated the effects of stability balls on the behavior of students diagnosed with ADHD (Schilling et al., 2003).

In 2003, Schilling and colleagues examined the use of stability balls in a 4th-grade classroom with 3 students diagnosed with ADHD. Using momentary time sampling (MTS; Rapp, Colby-Dirksen, Michalski, Carroll, & Lindenberg, 2008), out-of-seat behavior was measured before and after ball implementation. With all 3 students, results indicated that in-seat behavior improved dramatically over the course of the 12-wk intervention phase. Moreover, the students' legible word productivity also increased with the use of the stability balls (Schilling et al., 2003). The results of this study are promising because this design was the first to objectively measure the effects of stability ball use on the behavior of students with ADHD. Several limitations were noted in this study, however, and follow-up research was recommended for several reasons, primarily because the inherent limitation of such a small sample limits generalizability of findings. Moreover, only 1 classroom was included in the study, which also limits external validity. Finally, only in-seat and ball behavior was measured, limiting the degree to which on-task behavior was defined. For example, for many students, it is not only possible but also highly probable that off-task behavior could occur while seated (either in a chair or on a ball). For those reasons, in this study we addressed the limitations in the Schilling et al. (2003) study and further investigated the effects of stability balls on children's behavior in the classroom setting.

This study addresses two questions. First, does the use of stability balls increase the frequency of on-task and in-seat behavior for students identified with attention and hyperactivity concerns? Second, given the importance of social validity in the fidelity and implementation of interventions (Armstrong, Ehrhardt, Cool, & Poling, 1997), what are students' and teachers' perceptions of stability balls as chairs?

Method

Research Design

We used a single-subject A–B continuous time-series design using MTS. The university of Kentucky Institutional Review Board (IRB) approved all procedures for this study. Parental consent and child assent were exempt for this study as approved by the IRB, given that it was the school's initiative to implement stability balls in several of their classrooms. Thus, all students in the classroom received stability balls because these procedures would have been implemented regardless of our examination of the intervention's effectiveness.

Instruments

Attention–Deficit/Hyperactivity Disorder Test. The Attention–Deficit/Hyperactivity Disorder Test (ADHDT; Gilliam, 1995) was completed by four 4th- and 5th-grade classroom teachers for each student in their class. The ADHDT has 36 items comprising three subscales measuring hyperactivity, impulsivity, and inattentiveness. The three subscales are categories related to the diagnosis of ADHD in the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; American Psychiatric Association, 2000) and the professional literature. Test–retest coefficients averaged 0.91 (range =.78–.95), and correlation coefficients with other ADHD screening measures have also been moderate to high: Conner's Teacher Rating Scale (.72; Conners, 1997), Attention Deficit Disorders Evaluation Scale (.86; McCarney, 1989), and the ADDH Comprehensive Teacher's Rating Scale (.78; Ullmann, Sleator, & Sprague, 1991). This test has been shown to have sound psychometric properties: It has a 90% accuracy rate in diagnosing ADHD in children, particularly for those children whose ADHD composite score was at or above the 92nd percentile (Gilliam, 1995). This test was completed by the classroom teachers 2 wk before and 2 wk after the intervention.

Teacher Social Validity Scale. In addition to the posttest ADHDT scale, at the end of the intervention phase teachers were given a questionnaire developed by Alicia L. Fedewa to assess social validity. The questionnaire consisted of 8 questions and assessed effects on attention and work completion as well as the extent to which teachers would want to continue using stability balls in lieu of chairs. Teachers answered questions on a 5-point Likert scale that ranged from *strongly disagree* (1) to *strongly agree* (5). Some examples of questions are "Students listen and pay attention more when they're sitting on a ball" and "When students are seated on balls, they are better able to complete their work."

Participant Selection

The elementary school in which the study took place was located in a rural area in central Kentucky. This particular elementary school was part of the study by convenience because the principal of the school contacted us regarding the opportunity to conduct classwide interventions for off-task behavior across 3rd- through 5th-grade classrooms. At the beginning of the school year, all students across 4 classrooms were assessed by their teachers using the ADHDT. Among those classrooms, students who had a composite score of ≥120 (>92nd percentile, classified as "high" or "very high" probability of ADHD) were targeted for behavioral observations throughout the intervention. Thus, although all students received stability balls in lieu of chair seating, we observed only the students whose attention and hyperactivity levels were classified as most severe.

Procedures

Before implementation of the intervention, students were fitted for their stability balls using height measurements by a trained representative from WittFitt (www.wittfitt.com). Teachers answered students' questions about the stability balls after a brief training provided by the physical education teacher and the first author (Fedewa). For 2 full days before baseline data collection, students used the stability balls in lieu of their chairs to eliminate any novelty effects. Baseline data collection lasted 2 wk before the 12-wk intervention was implemented.

Data Collection

Data Collection and Training. One graduate student and two undergraduate students from the University of Kentucky served as observers. The primary investigator (Fedewa) led one 3-hr training session in each of the four classrooms to conduct reliability analyses among observers at the beginning of the academic school year. Four points of interreliability were collected both before and throughout the study. Average reliability among the raters was 93% and ranged from 88% to 100%. The mean score across raters was used to calculate weekly on-task and in-seat or on-ball scores.

Momentary Time Sampling. The children whose ADHDT score was at or above the 92nd percentile were observed using MTS (Rapp et al., 2008), wherein every 30 s, the observer would code the student's behavior on the basis of several behavioral classifications. Observers carried a stopwatch to record the 30-s time interval and marked their observations on each child's designated worksheet. This design was chosen because MTS at 30 s has been shown to reduce the number of false positives for duration events (Rapp et al., 2008). In effect, this MTS interval would serve to make the observations more valid and representative of the child's behavior throughout the baseline and observation periods.

Baseline and Intervention Data Collection. Baseline data collection lasted 2 wk. The observers visited the classrooms for the same 3 days per wk, 30 min per student observation, as in the intervention phase. The student observers sat on the perimeter of the room so as to be unobtrusive throughout the observation. In the 4 classrooms, the students who were identified as *high* or *very high* on levels of attention and hyperactivity were not distributed evenly. Of the 8 children, 3 were in one classroom, 4 were in two other classrooms (2 per classroom), and 1 was in the fourth classroom. Thus, for the observations, if >1 child was to be observed, the observer would remain in that classroom for the allotted 30-min interval for each child but would rotate the observations through a random sequence that was changed each week.

Baseline data were gathered by data collectors for 2 wk, 3 times per wk. The observations lasted 30 min for each child during language arts, mathematics, and social studies. Although the academic subjects occurred at the same time each day, children were observed on different days for the various periods. For example, one student may have been observed during mathematics on Monday but during language arts on Wednesday and social studies on Thursday. The next week, the same child would be observed during mathematics on Wednesday, language arts on Friday, and social studies on Monday. These rotations were consistent throughout the baseline and intervention periods, so the same procedures and data collectors were also used for the intervention data collection.

To carry out MTS, the observer first coded (every 30 s) whether the student was in seat or on ball or out of seat or off ball. Second, the observer also noted whether the student was on task or off task. Observers made both of these classifications because students could be on task but out of seat or off ball if they were getting supplies or talking to the teacher about the assignment. By contrast, students could be in seat or on ball but off task (e.g., talking to a peer, gazing, sleeping). Having both coding classifications allowed the observers to capture not only in-seat and on-ball behavior but also whether the student was attentive to the classroom task during the observation. With 30-min observations occurring 3 times per wk, observers captured 180 observation units per wk. We calculated the percentage of in-seat or on-ball and on-task behavior by means of a percentage of the total observations made for the day and week. Thus, if a student was on task for

40 observations on the first day, 20 observations on the second, and 30 observations on the third, the student would have an average of 50% on-task behaviors for the week.

Data Analysis

The stability balls served as the independent variable in the study and in-seat and on-task behavior, along with students' ADHDT scaled scores, served as the dependent variables. After individual data points were compiled, we calculated mean values for both ADHDT scores and students' (if applicable) observational in-seat and on-task behavior scores. We checked all assumptions before comparing differences across and within groups through visual inspection of the graphed data and residuals (Cohen, 1988). We reported descriptive statistics and conducted *t* tests to determine whether significant differences existed between ADHD behaviors from baseline and the completion of the intervention period.

Results

The 8 children observed in this study had a mean age of 9 yr, 11 mo. Of the 8 children, 6 were boys (4 African-American, 2 White) and 2 were girls (1 African-American and 1 White). None of the students observed were identified as students who were learning English as a second language. Five children had a diagnosis of ADHD, and the other 3 had behavioral concerns symptomatic of ADHD but without a formal diagnosis. None of the children were on medication (including the children diagnosed with ADHD) despite their elevated levels of attention and hyperactivity concerns. Whether the students diagnosed with ADHD were receiving additional therapeutic interventions at home is unknown, although all had an Individualized Education Plan for behavior and academic improvement at school.

We included 76 students in 4 classrooms in the analyses on the effects of the stability ball intervention (including the 8 children who were also observed). Of these 76 students, 39 (51%) were female and 37 (49%) were male; 42 (55%) were Hispanic, 20 (26%) were African-American, 12 (16%) were White, and 2 (3%) were classified as "other."

ADHDT Scores

We ran descriptive statistics and *t* tests for the general classroom and the 8 observed students with elevated ADHDT scores. As expected, we found considerable differences in the mean pretest ADHDT assessment ($t[71] = 9.8$, $p < .001$, $d = 0.79$, 95% confidence interval [CI] = 42.6, 64.4). The 8 students identified with elevated ADHDT scores had a mean quotient of 123; classroom peers had a mean quotient of 70 (standard deviation [*SD*] = 15). What is interesting, however, is the difference between these baseline scores and the postintervention ADHDT scores for both groups. For the general classroom, ADHDT scores dropped to an average quotient of 66 (*SD* = 13). Although not statistically significant or clinically significant (given that both scores reflect low levels of hyperactivity and attention), the overall drop in hyperactivity and increase in attention levels after the stability ball intervention is noteworthy even for students without prior attention difficulties. For the 8 students who began the intervention with heightened levels of attention and hyperactivity, ADHDT postscores had significantly decreased 2 wk after the intervention, with a mean quotient of 104 ($t[6] = 6.1$, $p < .001$, $d = 0.67$, 95% CI = 11.8, 26.9). This significant decrease also has clinical implications because an ADHDT quotient of 104 reflects a score in the upper average range of attention and hyperactivity, which can be markedly different in terms of classroom behavior from a child who scores in the very high or high clinical range.

In-Seat and On-Task Behavior

Classroom observations of the 8 students resulted in average weekly values of students' percentage of in-seat and on-task behavior. As depicted in Figure 1, students' in-seat and on-task behavior improved markedly over the course of the 12-wk intervention. With an average 45% of time spent in seat and an average time on task of 10% before the implementation of the stability balls, the postintervention observation results appear to have been effective. On average, the 8 children were seated on their ball approximately 94% of the time and on task almost 80% of the time.

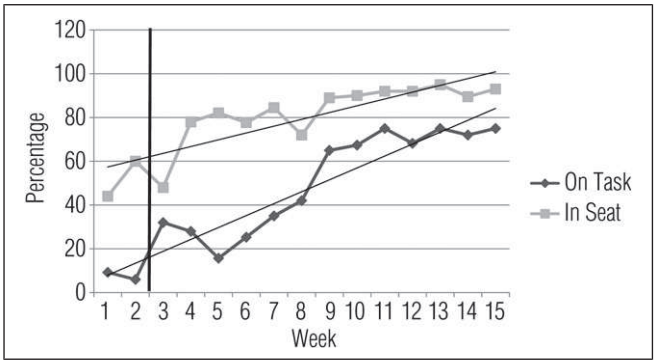

Figure 1. Average weekly percentages of students' on-task and in-seat behavior.

Note. Both on-task and in-seat behaviors are represented with trend lines. The thick, vertical line after Week 2 represents the completion of baseline data and the implementation of the intervention.

Social Validity Scale

All teachers completed a social validity scale assessing the degree to which they believed the stability balls helped their students' levels of attention, in-seat behavior, and work completion. On a scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), we calculated teachers' mean scores in the areas of improving children's attention, in-seat behavior, and work completion. Teachers rated all but one area in the *somewhat agree* to *strongly agree* categories: enhanced levels of attention (mean [*M*] = 4.0, *SD* = 0.71), in-seat behavior (*M* = 4.5, *SD* = 0.55), and work completion (*M* = 3.6, *SD* = 0.56).

Teachers also provided qualitative feedback. All but one teacher chose to share additional thoughts about the stability ball on the questionnaire. A common theme regarding social validity among teachers was their satisfaction with the stability balls in helping their students "calm down" by providing them "activity breaks on the balls." One teacher noted that the noise level in her class improved dramatically after the implementation of the stability balls. Another teacher stated that although she was initially concerned by the "constant moving and fidgeting on the ball," she realized there was a "decreasing shift in the amount of moving/fidgeting" in her students since the implementation of the stability ball intervention. The one disadvantage noted by a teacher was the expense of replacing the stability balls if they were to break. The financial costs of this intervention must be considered, given that school resources are often limited.

Discussion

We evaluated the effect of stability balls on 76 children's attention and hyperactivity levels and on 8 students' in-seat and on-task behaviors. The findings are promising in that all children who participated in this study had improved attention and hyperactivity levels when the stability balls were implemented in the classroom. However, the greatest effect of the stability balls occurred for the children who had significant difficulties in attending before the intervention. This study demonstrated that for the 8 children who were classified at or above the 92nd percentile in attention and hyperactivity difficulties, the stability balls appeared to have a dramatic effect in improving these areas of concern. Moreover, observer-reported levels of in-seat and on-task behavior also improved over the course of the intervention. It is not surprising, then, that teachers were satisfied with the effectiveness of stability balls in their classrooms.

Although the standardized data provide evidence of the improvement in children's attention and behavior in the classroom, teachers' and observers' qualitative reports of the intervention help us to understand why the stability balls may have had the noted effects. First, observers and teachers described the students as "more active" on the stability balls. As Schilling et al. (2003) found, students appeared to use the stability balls as "self-modulation of personal sensory needs" (p. 540). This explanation is likely one as to why the students' attention and on-task behavior increased because movement and physical activity have been shown to improve students' attention (Barros, Silver, & Stein, 2009; Bogden & Vega-Matos, 2000). Moreover, teachers noted that their at-risk students (those who were classified in the high or very high range of ADHD-type behavior) seemed to "enjoy the ball more, keeping them in their seat [ball] longer." Two teachers actually admitted wanting to "stop the students from bouncing" because they thought it might be a distraction to themselves and others. However, these teachers stated that they both discovered that the students' movement appeared to keep them in their seat and on task more than when they were using their chairs, as evidenced by the increase in students' in-seat or on-ball and on-task behaviors found in the MTS observations.

Finally, we must note the teachers' perceived success of the stability ball use. Although at first the teachers were hesitant and doubtful regarding their students' increased movement on the balls, they soon discovered that students' behavior was improving. These findings are important to keep in mind when consulting with teachers about the use of stability balls for their students because teachers may want to not use or stop using the stability balls because of these concerns. Teachers in schools are in a fundamentally different position than the teachers in this study, given that our teachers saw the use of stability balls as an experiment and were more likely to go along with the length of the intervention. If they had not been involved in this study, they may not have wanted to continue with the stability balls given their initial impressions of the students' increased movement and activity. Consultants and school-based therapists should be aware of these concerns and address them up front with teachers, validating what they will likely feel and experience when stability balls are implemented in their classrooms.

Limitations

As with any research design, inherent limitations must be addressed. Although larger than previous studies assessing the effectiveness of stability balls, the sample size was fairly small, which limits generalizability to other students and

classrooms. In addition, 12 wk might not have been long enough to thoroughly examine the effectiveness of stability balls on attention and behavior. Perhaps the novelty effect lasts longer than is assumed with stability balls, and thus the effects may not be as pronounced as if we had continued to examine the outcomes of children's on-task and in-seat behavior.

Moreover, it is unlikely that stability balls would be given to every student in a class, because schools' resources are typically limited, and only those students with heightened academic or behavioral concerns would be targeted for the intervention. Thus, it is important to consider the limitations that allowing every student to have a stability ball may have on generalizability of results. The beneficial effects may not be as large if only one or two students in a classroom use a ball, because ball use is not part of the classroom culture or rule structure. If only a small percentage of students in the classroom are using stability balls, then teachers may have a harder time controlling students' playing with or misusing them; using the balls may no longer be seen as a privilege but instead as a support or intervention for student inattention and hyperactivity, which may be more difficult to discipline.

Finally, we did not collect student reports of social acceptability; therefore, whether the students enjoyed the stability balls in lieu of chairs is not clear, nor are other advantages or disadvantages they may have perceived in using this alternative seating. Just as Schilling et al. (2003) found, students generally perceived the stability balls as positive additions to their classroom; however, one cannot assume this to be the case without providing concrete data of students' social validity.

Future Research

Given the limitations of generalizing from such a small sample of students, future research is needed to examine larger classrooms and groups of students who are identified with attention and hyperactivity problems. Additional research should also examine students who exhibit other types of difficulties not associated with ADHD, including those having trouble with work completion or other sensory issues (e.g., children with autism). Moreover, assessing a full school year would be important, ideally allowing for follow-up 1 year later to determine whether the intervention maintained its effectiveness in improving student behavior and attention. No research has examined the effectiveness of stability balls for such a long duration; such research is needed because, assuming prior success, students are likely to use stability balls for subsequent years. Finally, assessing students' perceptions of the intervention's effectiveness is critical because it helps inform school-based consultants what interventions students prefer and would buy into for improving their behavior and attention; subsequent research is needed to examine both teacher and student social validity of stability ball interventions.

In summary, this study's results are promising for the use of stability balls in classrooms. Such an intervention could be one effective means of improving the attention and behavior of children who are formally diagnosed with ADHD or who are perhaps exhibiting ADHD symptomatology. School-based therapists and consultants should consider this intervention when working with teachers who are in need of a simple yet effective means of engaging students who may otherwise be off task or inattentive. ▲

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