

Research Article

Effects of Yoga Intervention on Participation in a Regular Classroom Setting for a Child with Autism Spectrum Disorder

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Introduction: School age children with a diagnosis of Autism Spectrum Disorder (ASD) are at higher risk of demonstrating disruptive behaviors than typically developing children. Disruptive behaviors impact the ability to participate with peers in a regular education classroom setting. The purpose of this study is to determine if a yoga intervention is a beneficial modality to assist with participation in the regular school environment by decreasing disruptive behavior and increasing classroom minutes for a student with ASD.

Materials and Methods: This case study is a single subject ABA design (no intervention, intervention, no intervention) using an individually designed yoga intervention with extra visual cueing and physical prompting 3 times per week for 15 minute sessions for one calendar month in a regular school environment. The participant is a 9-year-old, male, elementary school student with a diagnosis of Autism Spectrum Disorder (ASD). The student has varied and limited participation in the regular school environment because of disruptive behaviors and his educational programming is directly affected by this. Two outcome measures were used: 1. Percentage of time in the regular education classroom and 2. Frequency of disruptive behavior. The school staff records all disruptive behavior episodes on a paper log.

Results and Discussion: There was a statistically significant change in the % of time in the classroom immediately post-intervention and there was evidence of a trend of decreasing disruptive behavior, although not statistically significant.

Conclusion: Yoga as an intervention offers promise to increase time spent in a regular classroom in a school aged student with ASD although the mechanism of this effect is unknown. Future random controlled trials using a double blinded approach would yield important information.

Keywords: Autism; Yoga; Physical therapy; Disruptive behaviors; Inclusion

Abbreviations

ASD: Autism Spectrum Disorder; CDC: Centers for Disease Control

Introduction

Autism affects in one in sixty-eight children in the United States [1]. Educating children with Autism Spectrum Disorder (ASD) presents a challenge for most school systems. In addition to providing supportive programming for cognitive and educational needs, schools must provide the myriad of social, emotional, communication, gross and fine motor interventions as well as deal with the atypical behavioral responses in ASD.

The interventions required to address the many facets of ASD are both intensive and expensive. While parents bear the most cost for the care of the child with ASD, school systems also carry a substantial portion of the financial burden including the cost for behavioral interventions. In the United States, the total estimated cost of care for a child with ASD is more than seventeen thousand dollars per year as

compared to a child who does not have autism [1]. The societal costs are even greater. The Center for Disease Control (CDC) has estimated the societal costs at over 11 million dollars [1].

Autism, a complex neurobehavioral disorder, involves impairments in communication, language and social skills as well as a demonstration of rigid repetitive behaviors [1-4]. Ninety percent (90%) of children with ASD display at least one challenging and disruptive behavior [5]. Lack of communication skills, difficulty negotiating social situations, sensory processing abnormalities and an overall feeling of anxiety and frustration are typically identified antecedents to challenging and disruptive behaviors [3,6,7].

Disruptive behaviors may present as mild such as making repetitive inappropriate noises to severe such as property destruction and physical aggression [3,5,7]. These behaviors are a form of communication for the child with ASD. There is typically a function or purpose behind the behavior [5]. Very often, the function can be identified initially as being biologically based but over time the disruptive behavior is established as a learned behavior [5,6].

School and ASD

When a child reaches school age, behaviors associated with ASD impact the child's ability to participate with their peers in the regular school setting. Under the Part B regulations of the Individuals with Disabilities in Education Act (IDEA), school systems must create an Individual Education Plan (IEP) for students with identified disabilities. The least restrictive environment must be used for education with the goal of inclusion in the regular classroom setting [8].

While school systems are required to provide education in the least restrictive environment, the removal of children with ASD from the classroom often occurs frequently in a school day if the child displays disruptive behaviors. Not only is the child's education impacted but also disruptive behaviors are at a significant risk factor for social isolation in school [5,6]. In addition, disruptive behaviors are not managed and controlled they will likely escalate and thus increase the time out of class and increase the risk of social isolation [4,5,7,9].

Many strategies have been employed by educators, researchers and families to regulate behavior and arousal levels in children with ASD [9-12]. Some of the strategies include Applied Behavioral Analysis, positive behavioral supports, sensory integration therapy, Developmental, Individual-differences & Relationship-based model (DIR) "Floortime", self-management skills education, communication intervention and exercise and complementary therapies including massage and yoga [10-12]. Having a variety of techniques in the 'tool box' is important because each child has unique disruptive behaviors and responds differently to interventions. For children with ASD who respond well to sensorimotor based interventions and are able to participate in self-management techniques, yoga is an important option for intervention [13-15].

Pediatric yoga

The benefits of yoga are well known. Yoga improves muscle strength and flexibility, oxygen uptake, hormone function and blood circulation [13,16]. In a systematic review examining the therapeutic benefits of yoga for children, Galantino and colleagues identified both physical and mental benefits. Physical benefits included improved cardiovascular fitness, improved musculoskeletal performance, and improved neuromuscular performance. The mental benefits included reduction in anxiety, reduction in stress, and improved behaviors including decreasing hyperactivity [13]. In addition, yoga has also been found to aid in the development of resilience in stressful situations [13,16-18].

Pediatric yoga is also important in the management of disability and chronic illness [13]. Small studies have shown multiple benefits of yoga including decreases in disruptive behavior [18-20]. For children with ASD, yoga can improve focus and attention, self-regulation, communication, sensory information processing and motor control [21,22]. Yoga interventions should be used as a complement to high validity and high efficacy behavioral interventions [22].

Physical therapists play an important role in providing movement-based interventions for children with ASD. In ASD deficits in sensorimotor functioning are often part of the disorder [23]. For the physical therapist working within a school system

there may be some resistance to the implementation of alternative approaches. Certainly, little is known about the effectiveness of yoga in children with ASD who present with problem behaviors [17,24-26]. However, often "everything" has been tried with the child to decrease ASD-related behaviors and nothing has worked. In this kind of situation, it is important for the school system, the family and the therapist to be willing to try a new approach such as yoga.

Research questions:

1. Does a yoga intervention decrease disruptive classroom behaviors?
2. Does a yoga intervention increase classroom participation time?

Materials and Methods

Participant

John is a 9-year-old boy with a clinical diagnosis of ASD and mood disorder. John has an Individualized Education Plan (IEP) including time out of the regular education class for individual programming and related services (physical therapy, social skills groups and DTI (Discrete trial training)). He has a one-to-one all day paraprofessional educator who is responsible for instituting a structured Behavior Intervention Program (BIP). In addition, a Board Certified Behavior Analyst (BCBA) manages his BIP. John also receives home intervention for specific behavioral and social skills program. Home and school services are coordinated through regular team meetings.

The behavioral interventions for John have been in place since kindergarten. However, for the past three years John has been exhibiting increasing difficulty with behaviors that interfere with school participation. These include self-injury, property destruction, physical aggression and disruptive behaviors. The behaviors for John were extremely variable in nature and intensity and were reported by his behavior analyst to be primarily driven by 'task avoidance'. In addition to the behavioral interventions John has received ongoing physical therapy to address low muscle tone, decreased age appropriate skills in balance, coordination and ball skills and poor physical participation in school curriculum, including recess and physical education.

Increasingly, negative behaviors have made John's participation in physical therapy sessions difficult, especially in groups. John requires consistent adult intervention to implement his specific behavioral plan. In spite of this, John would often need to be removed from group activities. The team of school professionals in this case was considering alternative interventions because John was reaching 'crisis mode' and conventional behavioral methods were not having a positive impact on his participation in his school day.

During group physical therapy sessions, yoga was informally introduced. John demonstrated varied participation; however, John expressed a preference for yoga over other types of exercises. With the team and families' approval and encouragement, a John participated in individual yoga session two times per week for two weeks to determine if a yoga intervention was suitable for John. He was able to participate in the yoga intervention.

Sequence		Description
Part 1 2-3 mins	breath work	Student's choice: Balloon breath, Bubble gum breath, Bee breath, Belly breath
Part 2 10 – 12 mins	breath & movement (asana)	<p>Focus on pairing breath with movement throughout this part. Student was able to complete up to 5 breaths while sustaining poses. The student named the poses.</p> <p style="text-align: center;">Sitting poses</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <u>moon</u> </div> <div style="text-align: center;">  <u>armadillo</u> </div> <div style="text-align: center;">  <u>pretzel</u> </div> <div style="text-align: center;">  <u>butterfly</u> </div> </div> <p style="text-align: center;">Prone poses</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <u>puppy</u> </div> <div style="text-align: center;">  <u>cat/cow</u> </div> <div style="text-align: center;">  <u>downward dog</u> </div> </div> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <u>roadrunner</u> </div> <div style="text-align: center;">  <u>cobra</u> </div> <div style="text-align: center;">  <u>mouse</u> </div> </div> <p style="text-align: center;">Supine poses</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <u>knees to chest</u> </div> <div style="text-align: center;">  <u>turtle</u> </div> <div style="text-align: center;">  <u>bridge</u> </div> <div style="text-align: center;">  <u>table</u> </div> </div> <p style="text-align: center;">Standing poses</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <u>mountain</u> </div> <div style="text-align: center;">  <u>moon</u> </div> <div style="text-align: center;">  <u>chair</u> </div> <div style="text-align: center;">  <u>monkey</u> </div> </div> <div style="display: flex; justify-content: space-around; align-items: flex-start; margin-top: 10px;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div>
Part 3 2-3 mins	quiet resting	Supine with eyes closed and guided meditation or quiet belly breath.

Figure 1: Yoga intervention.

Individualized yoga intervention was adapted from continuing education courses: Pediatric Yoga: Techniques for Sensory, Behavioral, Attention and other Developmental Disorders, developed by Allison Morgan MA, OTR, RYT Yoga for Children with Special Needs and Childhood Self-Regulation Techniques, developed by Kathyne Cammisa, MHE,OTR/L.

Intervention

This study is an ABA design (no intervention, intervention, no intervention) for a school-based yoga intervention three times per week for fifteen minutes per session. Each phase of the design lasted one calendar month, with the entire study completed over a 3-month time frame. The school physical therapist who has formal training in yoga served as the yoga instructor.

The yoga intervention provided was Hatha based with all sessions following a pre-established pattern; beginning with deep breathing in a sitting position (pranayamas-breath work), moving to postures with breath (asanas) and finishing the session with deep relaxation pose with eyes closed and guided, brief meditation (shavasana). The sequence of asana postures as shown in (Figure 1) was tailored to the student's level of participation. He was able to suggest and initiate preferred postures. Cueing to engage the breath, encourage inward focus and maintain body awareness were used and developmentally appropriate strategies were incorporated into the sessions.

The intervention was consistently in the morning during a mutually agreed upon time with his special education teacher. Primarily, the intervention took place in a designated room with

low stimulus, occasionally the physical therapy room and rarely in the student's resource room. A yoga mat designated the space in which the student would practice. The instructor's mat was positioned for optimal visualization of the student. The details of the yoga intervention were documented by the physical therapist after each session to record specific sequences and/or poses that were completed by the student and general information about the students' participation in the session.

Data and data collection

Two paraprofessional educators who support John collected the data for this study. Data collection was on paper then the data transferred to Excel. The principal investigator completed this task and then the data was checked for accuracy by the second investigator before the data was transferred into STATA 13 for analysis.

The independent variables are 'time out of regular education classroom' and specific behavioral information including 'disruptive behaviors', 'major property destruction', 'physical aggression' and 'self-injurious behavior'. The operational definition of disruptive behavior for the purposes of this research is: 'any inappropriate behavior that interferes with the student's initiation of tasks or task

Table 1: Descriptive statistics.

Intervention		Mean	Median	Min	Max	SD	N
Disruptive Behavior	Pre-intervention	3	2.5	0	11	2.61000	18
Disruptive Behavior	Intervention	3.11	2.00	0	9	2.742	18
Disruptive Behavior	Post-intervention	2.56	2.00	0	7	2.097	16
Total Disruptive Behaviors		2.9000	2.00	0	11	2.47500	52
% Time in class	Pre-intervention	93.5372	97.08	54.17	100.00	11.06621	18
% Time in class	Intervention	62.9433	74.58	0.00	100.00	36.08225	18
% Time in class	Post-intervention	88.2881	97.92	50.37	100.00	15.04361	16
Total % Time in class		81.3319	93.33	0.00	100.00	26.99000	52
Mins out of class	Pre-intervention	15.83	7	0	110	26.88	18
Mins out of class	Intervention	92.72	29	0	270	91.41	18
Mins out of class	Post-intervention	30.06	40	0	134	39.83	16
Total mins out of class		46.83	16	0	270	68.29	52

Table 2: % of Time in class.

Time Period	Obs.	Mean	Std. Dev.	95% Conf. Interval		P value
Month 1 vs. Month 2						
Month 1	18	.9353	.1106	.800	-.990	
Month 2	18	.6294	.3608	.450	-.809	
Diff	18	.3059	.3991	.107	-.504	0.005*
Month 1 vs. Month 3						
Month 1	16	.960	.013	.932	-.989	
Month 3	16	.883	.150	.803	-.963	
Diff	16	.077	.040	-.008	-.163	0.073
Month 2 vs. Month 3						
Month 2	16	.6074	.3712	.4095	-.8052	
Month 3	16	.8828	.1504	.8027	-.9630	
Diff	16	-.2754	.4258	.5023	-.0485	0.021*

Table 3: Disruptive behaviors.

Time Period	Obs.	Mean	Std. Dev.	95% Conf. Interval		P value
Month 1 vs. Month 3						
Month 1	16	2.875	2.729	1.420	4.329	
Month 3	16	2.563	2.097	1.445	3.680	
Diff	16	0.313	3.516	-1.561	2.186	0.727
Month 2 vs. Month 3						
Month 2	16	3.313	2.845	1.796	4.829	
Month 3	16	2.563	2.097	1.445	3.680	
Diff	16	0.75	4.107	-1.438	2.938	0.476
Month 1 vs. Month 2						
Month 1	18	3.000	2.612	1.701	4.299	
Month 2	18	3.111	2.748	1.748	4.474	
Diff	18	-0.111	4.086	-2.142	1.921	0.910

completion or inappropriate behavior that requires the teacher to stop instruction for other students and direct full attention to the student. These include refusing to attempt to complete a task within 10 seconds of a direction combined with: throwing himself on the floor, yelling/screaming, arguing, ripping paper, breaking pencils growling or threatening others'. Raw data of 'time out of the classroom' was tracked as minutes and matched with John's schedule to ensure that the time missed was during his scheduled time to be in the regular education classroom.

Results and Discussion

Descriptive

During the 52-day period of the ABA design study, the regular classroom day consisted of 270 minutes. On three days, there was a ½ day scheduled or the student was dismissed early. In the observational month preceding the intervention, there were eighteen days (equivalent to one school month) of observation. The pre-intervention mean of disruptive behaviors, as shown in (Table 1) was 3.0 with a range of 0-11. Pre-intervention the mean of the student's percentage of time in class was 93.5% with a range of 54% to 100%. The minutes out of class mean were 15.8 with a range of 0-110 minutes.

In the next consecutive month, the intervention was completed 9 times over a calendar month of school days (18 days). Two scheduled intervention days were missed because of John's inability to participate. As shown in (Table 1), the mean of the disruptive behaviors during the intervention period was 3.11 with a range of 0-9. The mean of the percentage of time in class was 62.9% with a range of 0-100%. The mean of the minutes out of class was 92.7 with a range of 0-270.

In the next consecutive month during the post intervention period the mean of disruptive behaviors were 2.6 with a range of 0-7. The percentage of time in class mean was 88.3 with a range of 50.4 to 100%. The minutes out of class mean were 30.1 with a range of 0-134. Across the entire period from pre-intervention to post-intervention the mean of disruptive behaviors was 2.6. The mean of percentage of time in class was 81.3%. The mean of total minutes out of class was 46.8.

T tests

A paired sample t-test was used to determine whether there was a significant difference in % of time and class and disruptive behaviors, comparing the pre-intervention (Month 1) and intervention (Month

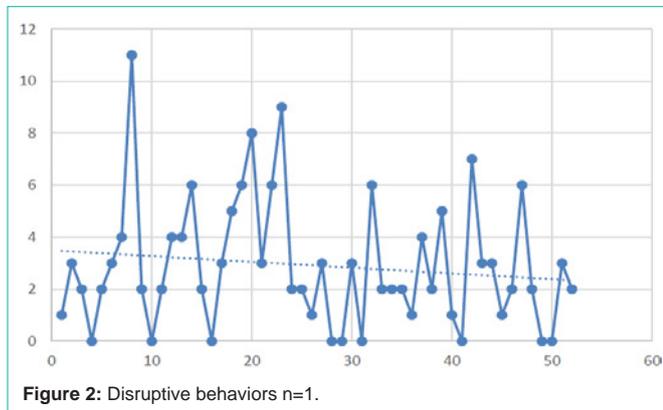


Figure 2: Disruptive behaviors n=1.

2), pre-intervention (Month 1) and post-intervention (Month 3) and intervention (Month 2) and post-intervention (Month 3). In the Month 3 there were only 16 observations. Examining % of time in class specifically, (Table 2) demonstrates a significant difference between the pre-intervention and intervention ($P = 0.005$); however, the mean of the intervention month shows less % of time in class, when compared to pre-intervention. There was no significant difference between the pre and post-intervention months, however there is a significant difference ($P = 0.021$) between the intervention month and post-intervention month, with a significant increase in participation noted post-intervention.

Analysis of disruptive behaviors as demonstrated in (Table 3), reveals no statistically significant difference ($P > 0.05$) when comparing pre-intervention to post-intervention, intervention to post-intervention or pre-intervention to intervention months.

Discussion

One of the most important metrics in ASD and children who are school age is the participation in regular classrooms and conversely behaviors that cause the child to be taken out of the regular classroom. Few approaches solve the issue of disruptive behavior in ASD although many approaches have and are tried. This research was completed as a framework for examining yoga as an intervention to increase regular education classroom participation for students with ASD with disruptive behavior; however, the results of the intervention were mixed.

When yoga is used as an intervention for ASD in research studies often the study does not identify the specifics of the yoga intervention. Specific protocols, in fact, are rarely reported [17]. We do include the protocol used in our study in order for others to use the protocol in this population.

Intensity of the intervention may have been a part of the inability to identify a significant statistical relationship; thus, the benefit of increased participation may have been seen with an increased frequency and duration of yoga session. Additionally, the pre-intervention trial yoga intervention may have had an impact on the overall decline in the disruptive behaviors. As shown in (Figure 2), disruptive behaviors did decrease but the mechanism of this decrease cannot be identified.

Individualized interventions for children with ASD are essential as their needs are unique and typically variable in nature. In the

evaluation and critical analysis of interventions provided, the $n=1$ design is a viable option for gathering evidence [27,28]. For this student in particular and with intensity of his behavioral presentation, this $n=1$ model of study was a valuable and appropriate way to assess if the complementary modality of yoga was beneficial.

The yoga intervention had unmeasured benefits. John's participation in individual sessions improved, as well as his ability to complete a variety of postures and breathing activities. The session provided John with autonomy and an opportunity to explore preferred poses and sequences and allowed time in his day for relaxation and regrouping. Over time, the ability to reconnect with breath and body may be an important skill for John or any student with ASD to access during the school day, in order to cope in times of distress.

Limitations of this study included the possibility of extraneous variables including co-occurring psychiatric conditions, medical interventions, sleep patterns, change in family dynamics or psychosocial aspects, change in staff and support services and the therapist-client interaction. It was not possible to account for all of these variables in this study; however, each would be important to take into consideration in future studies. While we did not use a validated behavioral measurement in this case study use of a validated behavioral measurement would increase both the internal and external validity of the results.

Conclusion

Complementary interventions including yoga for children with ASD are expanding; yet, it is often difficult to determine if the intended effect indeed occurs. Pragmatic random controlled trials with the inclusion of functional MRI (fMRI) must be conducted to determine the benefit of yoga as an intervention for ASD. This type of trial can help to establish the benefits of specific types of yoga as well as appropriate dosing and intensity for students with ASD.

The specifics of the yoga intervention were recorded in this study, whereas in previous studies the information about a specific protocol or routine was rarely reported [17]. In addition, including individual versus group sessions in future studies for students with ASD would be beneficial for both students and schools. Certainly group activities are less costly than individualized yoga interventions and may be more or less effective.

Yoga as an intervention appears to hold some promise as shown in (Figure 1) to increase the time in the classroom even if the mechanism is difficult to identify; moreover, it is an intervention that holds promise as a group intervention. Yoga interventions can be inclusive of all students, if in fact, group interventions are successful. Thus, both children with ASD and children without ASD would receive the benefit of yoga as an intervention.

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