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Alternative Therapies and Treatments and Their Effect in Reducing Behaviors Found Within Autism Spectrum Disorder

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ALTERNATIVE THERAPIES AND TREATMENTS AND THEIR EFFECT IN REDUCING BEHAVIORS FOUND WITHIN AUTISM SPECTRUM DISORDER

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Abstract

Autism spectrum disorders (ASD) are a group of neurodevelopmental syndromes characterized by deficits in communication, social interaction, imagination and sensory processing. The prevalence of ASD has increased significantly throughout recent decades. Given their concern about the diagnosis and their frustration that effective medical approaches are lacking, many parents and families of children with ASD have turned to alternative treatments and therapies for regulation of the behaviors and deficits observed in children with ASD. This literature review focuses on naming a variety of alternative treatments and therapies as well as examining their effectiveness for regulating behaviors in those diagnosed with ASD. Because it is a spectrum disorder, the severity and prevalence of symptoms will differ from each individual. Due to the varying degrees of this disorder and symptoms, the findings of this literature review conclude that it is best to try multiple methods of regulation and treatment. While many studies have shown to benefit children with ASD, it's best to keep in mind the combination of therapies and treatments, the age of the child and the purpose of the treatments and therapies being examined.

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CHAPTER I: INTRODUCTION

In special education there is and has been a growing number of students diagnosed with autism spectrum disorder (ASD). A reader looking for this type of information, could find a plethora of research about autism including: factors that contribute or could potentially cause autism during gestation, treatment for autism, medications, and a variety methods of reducing symptoms of autism.

In a special education classroom, time is spent daily working with students on behavior management and self-regulation for students with autism. These students often struggle to regulate their actions and emotions due to the different ways their brains process certain types of information. Professionals working in an educational setting need to understand how their students are affected by various stimulation and also be aware of a variety of holistic methods (deep pressure, music, movement, etc.) that they can try with their students to find the best way to help their students self-regulate in order to be ready to learn.

Overview: Historical Background

Autism spectrum disorders (ASD) are a group of neurodevelopmental syndromes characterized by deficits in communication, social interaction and imagination (American Psychiatric Association 2000; World Health Organization, 1992). It is increasingly recognized that these syndromes are additionally associated with abnormalities in sensory processing (Kern et al., 2006). The prevalence of ASD has increased significantly throughout recent decades, bringing the overall estimated prevalence to 11.3 per 1000 children (Marí-Bauset, Llopis-González, Zazpe, Marí-Sanchis & Suárez-Varela, 2015).

Many parents of children with ASD have turned to alternative treatments (Hanson et al., 2007; Harrington et al., 2006; Levy & Hyman, 2005) given their concern about the diagnosis and their frustration that effective medical approaches are lacking. This literature review will focus only on treatments that are natural or holistic with very low rates of side effects.

Deep pressure has been widely discussed since Temple Grandin described her self-designed "hug" machine. This machine was designed for giving her the pressure sensations that she craved (Grandin & Scariano, 1986). Deep pressure is based on sensory integration (SI) theory, meaning play and sensory-enhanced interactions are used to elicit the child's adaptive responses. This is as opposed to sensory-based interventions where adult-directed sensory modalities are applied to the child to improve behaviors associated with modulation disorders (Losinski, Sanders & Wiseman, 2016).

There are many methods of deep pressure treatment including weighted garments, swaddling, holding, stroking, hugging, squeezing and therapeutic brushing (Chen, 2013). Of the studies completed regarding sensory integration, many only look at deep pressure as a means of reward or used when a person is in distress.

In addition to deep pressure, kinesthetics and embodiment have also been shown to reduce the negative behaviors seen with ASD. In a study conducted by Fuchs (2005) he states, "our perception of the world, and thus our interaction with it, is entirely mediated by our bodies" (Fuchs, 2005, p. 3). Studies completed by Fuchs (2005) and Rosenblatt (2011) have found that movement therapies including dance and yoga have shown great benefits for individuals with ASD in decreasing negative behaviors.

Diet restrictions such as the elimination of gluten and casein are often used to decrease behaviors associated with ASD. Elimination of gluten involves excluding all the food items containing wheat, oats, barley or rye; that is, all flours, bread, rusks, pasta, pastries, and other bakery products made with these cereals. Elimination of casein involves avoiding the intake of dairy products: milk (including breast milk), yogurt, cheese, butter, cream or ice cream, among others. A strong commitment from families is needed in order to make this type of diet and treatment feasible for children with ASD. Those on a gluten free casein free (GFCF) diet were more likely to have a lower weight, BMI, and total energy intake than children with ASD on a regular diet. It is common for children on this type of diet to be lacking certain nutrient recommendations. Research to date has not confirmed the effectiveness of the GFCF diet, the evidence available remains limited and weak (Marí-Bauset et al., 2014).

Another reason we may see negative behaviors in children with ASD is due to a lack of motivation within the curriculum content in schools. Using educational games in teaching will increase learning of students by increasing motivation and enthusiasm of concepts (Moradi, 2017). Games can mix various active learning strategies such as roleplay, discussion, collaborative learning activities, small group discussion, reading and writing and speaking. The study done by Moradi also found that computer or video games can be effective in increasing learner motivation, self-esteem and attention reinforcement for students with special needs (Costa, Resende, Soares, Ferreira, Santos, & Moreira, 2009).

Autism spectrum disorder is very complex and there are many different approaches to try when searching for effective methods of treatment for children with ASD. Because it is a spectrum disorder, the severity and prevalence of symptoms will differ as well as the perceived effectiveness of the treatment or therapy in place. Due to the varying degrees of this disorder and symptoms, it is best to try multiple methods of regulation and treatment. This literature review is aimed to seek out a variety of alternative regulation methods (non-pharmacological, homeopathic remedies, therapy treatments, etc.) and determine whether or not they are effective in regulating students with ASD. Treatments and therapies that are effective could potentially be used at home or in schools to help students on the autism spectrum to be more successful in a school setting.

CHAPTER II: LITERATURE REVIEW

Research Strategies

To locate the literature for this thesis, searches of the following publications were conducted: Academic Search Premier, Alt HealthWatch, EBSCO MegaFILE, ERIC, Family & Society Studies Worldwide, Health Source - Consumer Edition, Professional Development Collection, PsycINFO and Teacher Reference Center. The research was focused on publications from 1992 to present. This list was narrowed by only reviewing published empirical study articles from peer-reviewed journals that focused on alternative medicines and therapy treatments for school aged individuals with autism spectrum disorder. The keywords that were used in these searches were "ASD," "alternative medicines," "deep pressure," "movement therapy," "diet autism," "technology autism," and "complementary alternative medicines (CAM)." The structure of this chapter is to review the literature on alternative treatments and therapies for school aged students with autism spectrum disorder in this order: Deep Pressure, Kinesthetics, Diet, Games and Other CAMs.

Alternative Treatments and Therapies

Autistic spectrum disorders (ASD) are a group of neurodevelopmental syndromes characterized by deficits in communication, social interaction, imagination and sensory processing (Kern et al., 2006). With the prevalence of ASD steadily increasing many parents have turned to alternative treatments given their frustration that effective medical approaches are lacking. Non-pharmacological, complementary and alternative medical (CAM) interventions to treat the behavioral symptoms of patients with ASD offer an

important alternative to established pharmacologic treatments with little to no side effects.

Deep Pressure

Deep pressure is based on sensory integration (SI) theory and has been widely discussed since Temple Grandin created her self-designed “hug machine” in order to provide the pressure sensations she was craving. Now, there are many types of deep pressure therapy methods including: weighted garments, swaddling, holding, stroking, hugging, squeezing and therapeutic brushing (Chen, 2013).

Deep touch pressure (DTP) “is a form of sensory integration therapy used in schools to help students with autism and other disabilities” (Losinski et al., 2016, p. 3). Sensory integration therapy continues to be one of the most commonly used interventions by occupational therapists for students with ASD (Lang et al., 2012). It is used to provide sensory input that is intended to calm individuals both physiologically (through input to the central nervous system) and psychologically (Grandin, 1992; Krauss, 1987).

For this study conducted by Losinski et al. (2016) there were two research questions asked: 1. What are the relative effects of studies examining DTP with students with disabilities, and 2. Does the use of DTP with students with disabilities meet the Council for Exceptional Children (CEC), 2014 standards for evidence-based practice (EBP). To determine the evidence base of DTP on the education outcomes of students with disabilities, the team conducted a systematic search of all publicly available experimental studies on the topic. To be included in this study, DTP needed to be

identified as the independent variable and all studies included either attention, disruptive behavior, self-injurious behavior or stereotypical behavior as a dependent variable.

The researchers reviewed 23 studies which met inclusion criteria. Within these 23 studies there were a total of 258 participants. The majority of the studies were conducted in a self-contained classroom or clinic. A large number of the studies targeted attention as their dependent variable followed by stereotypical behaviors, disruptive behaviors and then self-injurious behaviors and anxiety. Inventions within the studies included weighted vest, the Wilbarger protocol, compression vest and the hug machine. Sixteen of the 23 students used vests weighted with 5% to 10% of the participants body weight in 2-hr intervals as the independent variable (Losinski et al., 2016). Four of the studies focused on the Wilbarger protocol which is "an extremely specific procedure that mainly focuses on brushing the student with a specialized brush every 2 hr while the person is awake, for at least 2 weeks" (Losinski et al., 2016, p. 8). Two studies looked at the use of a compression vest and the final study examined the effectiveness of a squeeze or "hug" machine.

Many of the studies were found to be generally low quality (Losinski et al., 2016). The effects of DTP were small across the dependent variables of attention, disruptive behavior, self-injury and stereotypical behavior. The findings of this study showed that DTPs have very little positive effect on behavior. Losinski (2016) states that the effects of the analysis and those described by supporters (e.g., Grandin, 1992; Olson & Moulton, 2004) differ in their conclusions of whether the therapies are effective or not.

Another study was conducted on a 14 yr 6 mo male with ASD, severe DCD and Tourette's syndrome. This subject's name was Ernie, and he was a three-year resident of a state run facility for children with disabilities. Even as a toddler, Ernie had a history of self-injurious behaviors such as head banging and chin hitting. These behaviors were concerning because of their severity and they would often leave him bruised or bleeding. A number of interventions for his self-injury had been attempted, including wearing protective gear such as a helmet and chin guard, but unfortunately no prior interventions were successful.

Ernie took the anticonvulsant Depakene at a constant level prior to and throughout the duration of the study for the purposes of behavior management and control of possible seizures. Ernie's behaviors had decreased when he initially moved to the facility, however in the months prior to the study, his self-injurious behaviors had increased to be worse than they had been in the 12 months prior. Because of this, the therapists working with Ernie decided to try a weighted vest to calm these behaviors. Ernie was 96.25 pounds at the time of the study. Because there was no criteria of how heavy a weighted vest should be, the therapists recommended that the weight be 5% of his total body weight. For the purpose of this study, the weighted vest was 4.5 pounds.

Self-injury was measured in all sessions and defined as fist-to-chin contact, fist-to-body contact, self-slapping, self-biting, falling to the floor, and contacting his head to any solid object or person. A preference assessment was also measured, with preference being measured by reaching towards one of two objects.

The study consisted of three phases: an analog function analysis, a weighted vest assessment and a preference assessment. Each assessment was taken at approximately the same time each day within Ernie's room.

For the analog function analysis, five session types were performed (task, attention, tangible, alone, and control) each session lasted 10 minutes. The task condition consisted of 20 seconds of escape from demands contingent on problem behavior. An increase in the problem behavior would support the notion that escape reinforces the problem behavior. Within the attention condition, three to five seconds of attention were given based on problem behavior. An increase in the problem behavior during this condition supports the notion that positive social reinforcement reinforces the problem behavior. The tangible condition allows for 20 seconds of access to a preferred activity or item, contingent on the behavior. An increase in problem behavior would support that access to positive nonsocial reinforcement is preferred. "High rates of problem behavior in the alone condition (where the individual is alone in an empty room) and/or high rates across conditions help to contribute to the conclusion that the problem behavior is maintained by sensory stimulation" (Doughty & Doughty, 2008, p. 26). This would also suggest that high rates of the problem behavior is maintained by sensory stimulation.

After the analog functional analysis was completed, an analysis was then conducted to assess the use of the weighted vest. There were eight session types presented one time each in two phases. Phase one did not include intervening with the weighted vest while phase two included use of the vest. The sessions lasted 15 minutes each and the order was random. The conditions were the same as listed above: Attention,

where Ernie was given continuous attention by staff in the form of conversation; alone, during which Ernie was left alone with no attention, tasks or tangibles; control condition where staff responded to all initiations and Ernie received attention every 20 seconds from 3-5 seconds. During this condition no tasks or tangibles were present. Ernie was presented with academic tasks every 3-5 seconds, if Ernie responded correctly, brief praise was delivered. If Ernie responded incorrectly or failed to respond, he was shown the correct response and given 1-3 seconds to attempt a response. During all of the sessions, self-injury was ignored. If there were moments of severe self-injury, staff blocked it briefly and without comment.

Within each condition there were both vest and no-vest sessions. In the vest sessions, Ernie wore the weighted vest for the entire length of the session. There were few attempts where Ernie would attempt to remove the vest, in these attempts, staff would block the attempt and move on with the activity. There were three sessions conducted to determine whether wearing the vest influenced self-injury or if simply by having access to a preferred tangible (in this case, the vest) was influencing self injury.

The final assessment conducted in this study was a preference assessment that was based on procedures described by Fisher et al. (1992). This assessment was conducted to determine whether Ernie preferred the vest to other preferred tangibles. The items were presented in pairs, these pairs were placed in front of Ernie, once Ernie chose one of the two items, the unchosen item was removed. After which, Ernie was permitted 20 seconds to interact with the item or to wear the vest.

The results of this study within the analog functional analysis showed that self-injury occurred within all five conditions (Doughty & Doughty, 2008). The self-injury that took place was frequent and similar across the conditions. There was a significant increase during the task condition which may indicate that escape from tasks triggers Ernie's self injury. The weighted vest results show that there was no differential rate of self-injury or reduction in self-injury across all conditions as a function of the vest being worn (Doughty & Doughty, 2008). The results of the preference assessment show that the vest was determined to be a highly preferred item though, not the most preferred item present.

In the discussion of this study, Doughty and Doughty (2008), say their results are consistent with Mason and Iwata (1990) stating that "the only beneficial effects correlated with a sensory-integration technique were not due to the sensory integration process. Instead, any minor beneficial effects of Ernie's weighted vest were due to the vest being a highly preferred item" (Doughty & Doughty, 2008, p. 27). They go on to say that previous studies may also have had similar results for this reason.

The study conducted by Bestbier and Williams (2017) was designed to provide information about the extent of variability of the immediate responses to deep pressure by providing regular access to this type of treatment. This study involved 13 participants (11 boys, 2 girls) in a residential school environment. Three deep pressure methods were used for this study: massage, brushing and squeezing. A pretest-posttest design was used to evaluate the effects of the deep pressure sessions. For this particular study, five areas of mood and behavior were rated: calmness, engagement with activities, responsiveness to

instructions or other stimuli in the environment, happiness and communicativeness (Bestbier & Williams, 2017).

The staff administered deep pressure to the participants three times per day over a period of three months. Each session was between five and fifteen minutes in length and took place in a quiet places with minimal distractions. The staff rated the participants' behaviors for thirty minutes prior to the treatment and thirty minutes afterwards. Table 1 shows the results of each participant in each of the five areas of mood and behavior.

Table 1
Means And SD Recorded For The Scales Before And After Deep Pressure Sessions

Participant (# of sessions)	Scale	Before Session Mean (SD)	After Session Mean (SD)
Alison (130)	Calmness Engaged Responsivity Happy Communicative	7.84 (2.40) 7.73 (2.37) 8.17 (4.74) 7.26 (2.83) 7.94 (2.10)	8.99 (1.59) 8.87 (1.54) 8.88 (1.56) 8.78 (1.62) 8.87 (1.59)
Brian (45)	Calmness Engaged Responsivity Happy Communicative	5.74 (2.51) 4.66 (2.40) 4.74 (2.43) 4.92 (2.68) 5.64 (1.64)	7.20 (2.16) 6.59 (2.32) 6.39 (2.50) 6.91 (2.19) 6.78 (1.93)
Carl (40)	Calmness Engaged Responsivity Happy Communicative	7.35 (2.65) 6.78 (2.58) 6.93 (2.56) 6.85 (2.83) 5.92 (2.87)	8.84 (1.12) 8.51 (1.49) 8.66 (1.35) 8.67 (1.31) 8.08 (2.19)
David (17)	Calmness Engaged Responsivity Happy Communicative	5.89 (2.49) 5.52 (2.58) 5.87 (2.44) 6.15 (2.59) 6.22 (2.96)	8.48 (1.08) 8.03 (1.57) 8.24 (1.20) 8.19 (1.53) 8.06 (1.78)
Eric (49)	Calmness Engaged Responsivity Happy Communicative	4.68 (2.78) 4.65 (2.61) 5.29 (2.37) 5.69 (2.61) 5.06 (2.35)	7.69 (2.04) 7.27 (2.15) 7.65 (2.08) 8.02 (1.86) 7.55 (1.98)

Fenella (17)	Calmness Engaged Responsivity Happy Communicative	5.71 (2.35) 4.49 (2.60) 4.99 (2.36) 5.30 (3.01) 4.71 (2.76)	5.99 (2.40) 4.90 (2.60) 4.99 (2.64) 5.19 (2.75) 4.85 (2.53)
Graham (39)	Calmness Engaged Responsivity Happy Communicative	7.51 (1.91) 7.04 (2.41) 7.32 (2.35) 8.12 (1.86) 7.58 (2.14)	8.66 (1.10) 8.24 (2.18) 8.31 (1.85) 9.04 (0.94) 8.66 (1.16)
Herbert (48)	Calmness Engaged Responsivity Happy Communicative	5.83 (1.91) 4.61 (2.13) 5.39 (1.97) 5.84 (2.13) 4.89 (2.07)	6.83 (1.92) 6.33 (2.08) 6.40 (1.95) 6.82 (1.89) 5.90 (2.20)

While deep pressure appeared to be beneficial for most of the participants, the effects were not uniform across all areas of functioning and it is clear that there are individual differences in response to deep pressure that should be taken into account when providing deep pressure interventions. The variability in individual responses indicates that it should be tailored to the needs of the recipient (Bestbier & Williams, 2017).

Kinesthetics

In a study completed by Hildebrandt, Koch and Fuchs (2016), the authors discuss the approach of embodiment in people with deficits in social interaction. Embodiment brings to focus body-oriented intervention methods based on a theoretic framework that explains the disorders on a more basic level than common theory of mind approaches (Hildebrandt, Koch & Fuchs, 2016). This approach assumes that cognition in general is essentially grounded in bodily states (Conson et al., 2015). Fuchs explains this further in his 2005 study (Fuchs, 2005) stating that our perception of the world is entirely mediated

by our bodies. His idea is that if we perceive an object, this perception becomes apparent to us by the reactions of our receptors. In addition, perception leads to the awareness of our own body movement within the environment. This means that any changes in the normal functioning of our perception and movement via our brain, can influence our experiences of the world.

For this study, the participants within the treatment group received ten weekly sessions of dance movement therapy (DMT), while the participants in the control group continued their regular daily routines. The DMT sessions took place at the same time each week for 60 minutes. The sessions included three mirroring exercises and one verbal processing element (Hildebrandt et al., 2016). Each session opened with a ten minute, client-centered interactional intervention. During which, the therapist would adopt the movements of the participants while creatively modifying them into related movement qualities with the group ("can we make this bigger, smaller, lighter, more direct, quicker, slower?") (Hildebrandt et al., 2016, p. 5). By doing this, the therapists were able to provide a versatility and clarity in movement while inviting others to join in. Afterwards, the participants would split into groups and take part in a mirroring exercise for about 15-20 minutes. Each participant would lead, follow and then move together with their partner. The group then came back together for a circle activity where they mirrored the movements of one participant who self selected a song and stood in the middle of the circle. The last part of this study was the verbal processing portion (10-15 minutes). During which, the participants discussed feelings related to their selves and others and their wishes with a therapist. These verbal responses were not collected as part of the data

for this study. The authors determined that the stereotypical and flat responses, typical to those with ASD were not as valuable as the movement responses and nonverbal portions of the study.

Due to financial and other various limitations, Hildebrandt suggests that further research should measure each part of the intervention; e.g., after mirroring and after group mirroring to be able to differentiate more effective from less effective interventions (Hildebrandt et al., 2016). The mean symptom reduction in the treatment group was 15.27%, while symptom severity worsened by 6.99% in the control group. The findings show influential factors on the decrease of negative affect, and thus the improvement of emotion expression.

Yoga has also been studied as a form of CAM for behavioral problems. Due to the positive effects of music in preliminary studies authors Rosenblatt et al. (2011) developed a combined yoga, dance, and music therapy, based on the critical factors that elicit the relaxation response (RR) and examined its effect on the behavioral symptoms of children with an ASD (Rosenblatt et al., 2011).

The subjects for this study were children with a diagnosis of ASD and a mean age of 8.9 (range from 3.6-16.5 years of age). There were 22 (92%) males and two (8%) females, consistent with population-wide gender distribution for autism (Rutter & Moffitt, 2003). Subjects included in the group were those whose parents completed both the pre- and post-screening questionnaires and who attended a minimum of one session. In order to gather pre- and post-treatment data, the parents were asked to fill out the following assessments; BASC-2 which measures aggression, anxiety, attention problems,

atypicality, conduct problems, depression, hyperactivity, somatization and withdrawal; The Aberrant Behavioral Checklist (ABC) which assesses irritability, lethargy, hyperactivity, stereotypy, and inappropriate speech. An aggregate score was computed for the ABC Irritability Scale and the BASC-2 Scales that evidenced significant post-treatment changes. This was done by averaging the T-scale value for the combination of the ABC Irritability scale and the scales that significantly changed on the BASC-2. The authors predicted that these aggregate scores would show post-treatment reductions, particularly for the latency-aged children (Rosenblatt et al., 2011).

The treatment groups consisted of between two and five children, all of which were accompanied by a parent or caregiver, who participated in the activities of the group, and assisted their child when necessary (Rosenblatt et al., 2011). After an initial pre-testing session, the study consisted of eight treatment sessions of 45 minutes each. A final summary and post-testing session was completed after the eight sessions. Lucy E. Rosenblatt, a licensed clinician and certified yoga/dance therapist led the sessions. In order to create predictability, familiarity and in an attempt to reduce anxiety, each therapy session followed the same format each time. The sessions included (in sequence): breathing techniques of RR (10 minutes), yoga postures (10 minutes), music and dance (20 minutes) and typical yoga relaxation (5 minutes) (Rosenblatt et al., 2011). For each session, verbal instructions were accompanied by pictures and examples

By the end of the eight weeks, most children were able to execute the 18 different postures. Parents were then asked to fill out the post assessment forms (BASC-2 and ABC). The results of the BASC-2 show that, of the three composite clinical scaled

(Behavioral Symptom Index or BSI, Externalizing and Internalizing) only the BSI showed improvement while comparing all subjects. Within the subjects ages 5-12 (latency-aged), all three scales showed a change with the BSI being the largest change for this group (Rosenblatt et al., 2011). The Aberrant Behavioral Checklist (ABC) showed no change for the subject group as a whole. For those within the latency-age group, there was an overall improvement for the Irritability scale (Rosenblatt et al., 2011). In addition, the latency group also showed greater post-treatment changes based on the combined BASC-2 and ABC scores.

With the scores having the most significant change in the latency-aged subjects, the authors suggest that "during this developmental period, patients with ASD may have greater receptivity to the program's unique emphasis on movement and sound" (Rosenblatt et al., 2011, p. 1033). The two BASC-2 scores that changed amongst the group as a whole and the latency group alone (BSI and Atypicality) were two of the four BASC-2 scaled recently identified as having high sensitivity and specificity for screening patients with ASD (Volker et al., 2010).

Few limitations were listed as part of this pilot study. One of which was the lack of information regarding the medication status of the subjects. There was also a lack of data obtained from subjects regarding how often they practiced the yoga routine at home to determine whether home practice enhances efficacy of the intervention (Rosenblatt et al., 2011). Overall, the results of this study suggest that a multimodal relaxation program have a positive impact on behavioral and cognitive symptoms.

Diet

Scientists began noticing and studying a correlation between ASD and gastrointestinal (GI) problems as early as 1971 (Ferro & Prasad, 2016). In a 2013 study (Mazurek et al., 2013) researchers examined 2,973 records across the United States and Canada. They found that 24% of the children experienced at least one chronic digestive issue. Another study (Buie et al., 2010) reported a relationship between GI issues and worsening behaviors in children with ASD. This study suggests that for a child with ASD, a response to abdominal pain or discomfort may manifest in vocal and/or motor behaviors, or changes in overall state. Multiple studies have found altered intestinal bacteria in children with autism (Ferro & Prasad, 2016).

Children with ASD who have GI issues have similar intestinal characteristics of people with Crohn's disease and ulcerative colitis. These characteristics include a less diverse microbiome, an unbalanced microbiota and increased intestinal permeability (Ferro & Prasad, 2016). Studies that have been conducted on participants with Crohn's disease and ulcerative colitis show that dietary changes such as exclusive enteral nutrition (ENN), a low-FODMAP diet and the specific carbohydrate diet (SCD) may help these GI symptoms.

Exclusive enteral nutrition involves receiving nutrition from a feeding tube, not by mouth. This method has been shown to shift the microbiome, decrease intestinal permeability and lead to 85% remission of pediatric Crohn's disease patients (Critch et al., 2012). FODMAP is an acronym for fermentable oligio-, di-, monosaccharides and polyols. The idea behind a low-FODMAP diet is that certain rapidly fermentable

carbohydrates are poorly digested which leads to abdominal pain, bloating and diarrhea and constipation (Halmos et al., 2014). The low-FODMAP diet removes gluten, high levels of lactose and high fructose corn syrup from the diet. A specific carbohydrate diet (SCD) is premised on the idea that certain types of carbohydrates are not being fully digested, leading to an overgrowth of harmful bacteria in the small intestine (Ferro & Prasad, 2016). This diet restricts bread, rice, potatoes, added sugars and food additives. This diet works by shifting the composition of the intestinal microbiome, including increasing the bacterial diversity. Both the low-FODMAP diet and the SCD are suggested dietary changes for children with ASD; however, Ferro & Prasad (2016) suggest using a casein-free version of each.

Elimination of casein involves avoiding the intake of dairy products: milk (including breast milk), yogurt, cheese, butter, cream or ice cream, among others. It is only feasible for children to follow this type of diet if parents and caregivers show strong commitment (Marí-Bauset et al., 2014). A gluten free casein free (GFCF) diet has become popular amongst families wanting to reduce typical behaviors seen in children with ASD. Elimination of gluten involves excluding all the food items containing wheat, oats, barley or rye; that is, all flours, bread, rusks, pasta, pastries, and other bakery products made with these cereals.

In a study completed by Marí-Bauset et al. (2015), the authors examined the impact of a GFCF diet in children with ASD. The participants in the study were ages 6-9 years old. In order to be a part of the study they needed to be on a GFCF for at least three months. Children could not be a participant of this study if they: failed to attend study

appointments or to complete the dietary records; used dietary supplements; had diagnosed health problems such as endocrine or metabolic diseases which would affect the intake of nutrients; or if they were taking any drugs (e.g., atypical antipsychotics, mood stabilizers, tricyclic antidepressants, steroids, or stimulants, among others) that could modify food intake (Marí-Bauset et al., 2015). The participants of this study who met all criteria included 20 (17 boys and 3 girls) on a GFCF diet, and 85 (76 boys and 9 girls) on a regular diet, which accounted for the control group.

During appointments, the children had their height and weight measured by a registered dietitian who was also the principal investigator. The participants' BMIs were then calculated by gathering the mean of the height and weight. Each participant's BMI was then recorded as data. In addition to the BMI, data was also taken on the child's age and other medical history using a questionnaire. If the children then met the criteria and the parents also agreed to the study, the children were invited to participate. The parents were then given explicit instructions on how to assess the food and drink consumed by their children and how to estimate and record portion sizes (measured or assessed by a visual guide, which was provided to improve accuracy) of each item ingested. Parents were asked to submit food labels with ingredients, brands, added ingredients and recipes for homemade dishes whenever possible (Marí-Bauset et al., 2015).

In this particular study, children with ASD on a GFCF diet were more likely to have a lower weight, BMI and total energy intake than children with ASD on a regular diet. However, the calcium intake of these children on a GFCF diet failed to meet nutritional recommendations. It is common for children on this type of diet to be lacking

certain nutrient recommendations. Children on the GFCF diet showed less of a tendency to be overweight or obese than those on a regular diet. Research to date has not confirmed the effectiveness of the GFCF diet but the evidence available remains limited and weak (Marí-Bauset et al., 2014). The authors of this study found that children were consuming "hidden dairy" which shows a need for careful analysis of data in the efficacy of studies to follow. A limited diet may also promote other's perceptions that the child is different, therefore limiting social opportunities for children with ASD. Because of this, it is recommended that these diets be introduced on a case-by-case basis "only after diagnosing any intolerance or allergy to allergens in the foods to be limited from the diet, or other conditions which suggest the child is likely to benefit" (Marí-Bauset et al., 2014, p. 682).

Another study on GFCF diets for children with ASD was conducted by Hyman et al., 2016. For this study the participants underwent screening and initial evaluation to determine their diagnosis of ASD and cognitive functioning levels. They were also screened for any medical conditions which may alter the response to the GFCF diet. These screenings included ruling out celiac disease, identifying children at risk for allergy to ingredients and blood work to determine iron deficiency and vitamin D deficiency. The remainder of the study included three phases: implementation, challenge and maintenance.

During the implementation phase, baseline data was obtained on the children's behavior and nutritional status. Next, the researchers implemented the GFCF diet by providing a dietician to go to the families' homes to educate them about the dietary

restrictions. She also made weekly phone calls to the families in order to provide additional support and teaching.

The children maintained the GFCF diet for an additional 4 weeks after the 2 week baseline period. After these 6 weeks total, the participants entered the challenge phase. The researchers used a double-blind, placebo-controlled design (Hyman et al., 2016) to deliver weekly dietary challenges. These challenges occurred one time per week for 12 weeks and included four challenge foods: foods that contained gluten only, casein only, both gluten and casein or neither (placebo). The foods were developed for each child based on child's taste and texture preferences, the four snacks were indistinguishable from one another. The researchers chose to introduce the challenge foods only once per week based on surveys indicating that 94% of adverse reactions to gluten and casein resolve in a week (Hyman et al., 2016). The behaviors of the participants were observed by the research assistant, parents and ABA therapists the day before, day of and 24 hours after the challenge and all observations occurred at the same time each day.

After all 12 challenges were given, during the maintenance phase, the children remained in the study for an additional 12 weeks where families were free to maintain, modify or abandon the diet. At the end of the maintenance phase, the researchers re-assessed the children's behavioral and nutritional status.

Outcome measures were recorded based on physiologic functioning, challenging behaviors (not specific to ASD) and behaviors associated with ASD (Hyman et al., 2016). For physiologic functioning, parents recorded stool frequency and consistency using the Bristol Stool Scale. Parents recorded sleep by completing sleep diaries, activity and

attention by completing the Conners Abbreviated Rating Scale. Behaviors associated with ASD were measured using the Ritvo-Freeman Real Life Rating Scales.

The outcome of this study did not detect an impact of dietary restrictions on measures of physiologic function, behavioral disturbance or ASD related behaviors (Hyman et al., 2016). Hyman (2016) states that reasons other research may have found benefits for a GFCF diet in children with ASD is that their studies are often based on reports of only parents observations and also that other studies have been based on a one-year trial in which the participants received a range of interventions outside of the study. The study conducted by Hyman et al. (2016) also did not include children with significant gastrointestinal diseases, so it may be possible that these children would experience more benefit from GFCF diets. Hyman (2016) calls her study the "tip of the iceberg." She explained, "There are many possible effects of diet (in children with ASD), including over- and under-nutrition or behavior, that need to be scientifically investigated so families can make informed decisions about the therapies they choose for their children" (Hyman, 2016, p 3).

Technology

Children with autism struggle with motivation for formal education practices as well as follow through on homework assignments. Using educational games in teaching will increase learning of students by increasing motivation and enthusiasm amount and also level of independence needed to complete homework (Moradi, 2017). Games can mix various active learning strategies such as role-play, discussion, collaborative learning activities, small group discussion, reading and writing and speaking. The study done by

Moradi also found that computer or video games can be effective in learner motivation, self-esteem, attention reinforcement, as reward and outer reinforcement, operating and social interaction increase, intermediary between therapist and student with special needs (Costa et al., 2009).

For this study by Moradi (2017) there were 30 school aged boys as study participants. Of the 30 participants 15 were randomly placed in the test group and 15 in the control group. The researchers made a learning test that was used for the students' learning. The test included 20 questions as short answer, blanks and multiple choices (Moradi 2017). The pretest was conducted in both groups, during which the questions were read and recorded by the researcher. The researcher then presented the lesson in its entirety to the test group (addition, subtraction, multiplication and division concepts). The test group was able to use computer games as an exercise for each concept taught (Moradi, 2017). In the control group the exercises were done without computer games. The post-test portion of the study was then completed in the same way as the pre-test. The researcher then analyzed the data from the post-test.

Based on the results there was a greater improvement in scores on the post-test with the test group than there was with the control group. The test group scores improved by 2.15 standard deviation while the control group only improved by 0.57 standard deviation.

Another way that games can be used to help support children with autism is through prosocial interactions and leisure activities. Through age appropriate games, children with disabilities may have an increased quality of life and increased

opportunities to learn social skills. One way to help teach leisure skills to a child with ASD is by video modeling. Video modeling involves the child viewing a video clip which provides a model for them to imitate. This method has been used in many ways to promote learning, one study used video modeling to increase appropriate toy play while also decreasing repetitive behavior for individuals with ASD (Blum-Dimaya, Reeve, Reeve, & Hoch, 2010). In the study conducted by Blum-Dimaya et al. (2010) children with ASD were taught an age appropriate video game (Guitar Hero II™) in order to increase prosocial interactions for the children. The participants of this study all had the abilities to match colors and had the fine motor skills to manipulate the Guitar Hero II™ controller. The participants were also able to follow a photographic activity schedule which they used to set up and shut off the game, this task analysis can be seen on Table 2 below.

Table 2
Task Analysis for Playing Guitar Hero II™

Task
1. Obtain materials
2. Put game cartridge in game system
3. Insert yellow plug in hole
4. Insert white plug in hole
5. Insert red plug in hole
6. Press switch in back of game system
7. Turn on TV
8. Make sure video is on
9. Press reset button
10. Put on guitar (handle to le over right shoulder)
11. At START screen press green button

12. On Training press green button
13. Strum down once to the word PRACTICE
14. Press green button
15. Strum down ___ times (to correct song)
16. Press green button
17. Press green button Strum up to EASY
18. Press green button
19. On FULL song press green button
20. Strum down 3 times to SLOWEST
21. Press green button
22. Play song
23. Scroll down 5 times to Exit button
24. Press green button
25. Turn off system in the back
26. Turn off TV

In addition to the photographic activity schedule, students completed a video model which played simultaneously with the game on the TV screen.

Data was collected for schedule completion and on-task behavior. During each session an observer scored whether the child accurately completed each component of the photographic activity schedule; three responses were required to score a step of the task-sequence as correct: (a) pointing/looking at the page, (b) completing the target behavior, and (c) turning the page of the schedule. The observers also scored on-task behavior

which was defined as (a) visually attending to the materials by orienting the head within approximately a 45-degree field of view of the materials, (b) looking at the schedule, (c) manipulating the materials as they were designed to be used, or (d) transitioning from one scheduled activity to another.

The study conducted by Blum-Dimaya et al. (2010) demonstrated that a training package consisting of an activity schedule, simultaneous video models and multiple-exemplar training was effective in teaching young children with ASD an age appropriate leisure skill. The participants were not only able to continue these skills once the prompts were removed, but they were able to also generalize the skills to settings outside of the teaching environment.

These educational technologies can be effective in learners to improve motivation, self-esteem, attention reinforcement, social interaction, intermediary between therapist and students with special need (Costa et al., 2009).

Other

There are many other alternative medicines and treatments that have been used to regulate and decrease behaviors seen in ASD. The use of medical marijuana is another topic found in researching natural ways to help the struggles of people with ASD. While there is very little research regarding the effects of cannabis on symptoms of severe autism, there were a few anecdotal articles to be found on this topic. One mother states that her son's aggressive and violent behaviors have been greatly reduced by her homemade marijuana cookies. Other researchers state that THC can affect certain receptors in the brain, releasing oxytocin and resulting in less anxiety and more positive

social behaviors in students with autism. Unfortunately, there is not enough scientific research on this topic to draw any sort of conclusion whether or not marijuana is a safe and effective naturalistic method of treatment for individuals with autism.

In a study completed by Hopf, Madren and Santianni (2016) 194 parents or primary caregivers in Virginia completed an online survey and answered questions about complementary and alternative medicine (CAM) use for their children with ASD. The parents rated their perceived effectiveness of each therapy. The children with ASD in this study were more likely to be male than female (78.4% versus 17.0%), which mirrors the sex distribution of the autism population at large in the United States (Centers for Disease Control and Prevention, 2013). Of the 194 study survey participants, 157 (80.9%) of them use CAM with their child with ASD. Table 3 shows other health issues prevalent in the study participants while Table 4 lists the different CAMs being used and their level of perceived effectiveness.

Table 3
Survey Respondent Demographics and Child Characteristics

Variable	All parent/caregiver survey respondents (n = 194)	Parent/Caregiver respondents who use CAM on their child (n = 157)
Does your child have one more of the following health issues? (%)		
Digestive disorders	53.1	58.6
Sleep disorders	49.0	52.9
Immune system disorders	45.9	52.2
Psychiatric disorders	43.3	44.6
Neurologic disorders	19.1	22.9
Genetic disorders	6.7	5.7
Metabolic disorders	4.1	5.1

Table 4
Top Three CAM Therapies Regarding Use and Perceived Effectiveness: Parent Responses by Therapeutic Category

Variable	Parent/Caregiver respondents who use CAM (n = 157) %	Average rating of effectiveness (scale 1-5) among CAM users
Diet modifications or restrictions		
Gluten-free, casein-free diet	54.8	4.17
Low sugar/no sugar	28.0	4.23
Gluten-free diet	26.8	3.95
Vitamin and/or mineral supplements		
Multivitamin	58.6	3.68
Methyl B-12 injections	54.1	4.01
Zinc	29.9	3.96
Amino acid and other nutritional supplements		
None	53.5	n/a
Fish oils/essential fatty acids	51.6	4.10
Digestive enzymes	28.0	4.05
Bodywork or energy work		
Prayer (on behalf of child)	40.8	4.23
None	24.2	n/a
Massage therapy	22.9	4.08
Detoxification therapies		
None	40.8	n/a
Epsom salt baths C	36.3	3.81
helation-DMSA	18.5	3.94
Hormone therapies		
Melatonin	45.2	4.50
None	40.1	n/a
Oxytocin nasal spray	14.0	3.76
Off-label use of prescription medications		
None	42.0	n/a

Oral antifungals (e.g., nystatin)	42.0	4.41
Oral Anti-inflammatories	12.7	4.00
Oral antifungal agents (nonprescription)		
Probiotics	52.2	4.26
None	38.9	n/a
Grapefruit seed extract	15.3	3.96
Herbal therapies		
None	65.0	n/a
Curcumin	14.0	3.54
Homeopathy	8.3	4.29
Miscellaneous CAM therapies		
Sensory integration therapy	43.3	4.52
Music therapy	22.9	4.24
Auditory integration therapy	19.7	4.18

Among the CAM therapies, the most frequently used treatments were multivitamins (58.6%); the gluten-free, casein-free diet (54.8%); and methyl B-12 injections (54.1%). The CAM therapies with the highest average rating of perceived effectiveness were sensory integration therapy (4.52), melatonin (4.50), and the off-label use of prescription antifungal medications (4.41). The use and high ratings of effectiveness of prescription antifungal medications are interesting findings because this is a novel (off-label) use of these medications, presumably for remedying disturbances in the gastrointestinal tract due to overgrowth of candida (yeast) (Hopf et al., 2016).

The results of this review show that there has been an increase from other studies (Hopf et al., 2016) in the number of parents (80.9%) who have tried some form of CAM on their child with ASD. Parents serve as an enormous source of information and

experience regarding how to live with and manage the symptoms and features of autism. This exploratory study sought to tap into that base of information with regard to CAM use by parents on their children with autism (Hopf et al., 2016). Few studies have been completed to include the parents' perceived effectiveness of the CAMs (Christon, Mackintosh & Myers, 2010, Goin-Kochel, Mackintosh & Myers, 2009). The findings from this community sample of parents are similar to those of other studies, suggesting that CAM use is common in the autism community (Hopf et al., 2016). The review also shows that many of the therapies are perceived to be effective in improving the health or functioning of children with ASD.

Other types of interventions include early, intensive behavioral interventions which focus on developing language, social responsiveness, imitation skills and appropriate behaviors (Hojjati, 2014). Examples of these behavioral therapies include Applied Behavior Analysis (ABA) and Treatment and Education of Autistic and Related Communication Handicapped Children (TEACCH). These behavioral techniques should begin early in the pre-school period and be followed by highly individualized educational intervention in the school (Hojjati, 2014).

This study, completed by Hojjati (2014), aimed to determine the effectiveness of Holistic Multidimensional Treatment Model (HMTM) in the treatment of children with ASD. This method has the following features:

1. All aspects of child's growth (affective, emotional, cognitive, physical and emotional), is checked, and baseline training and treatment starts from current status of the child.
2. Emphasis on a deep emotional connection and sense of security for child.

3. Emphasis on selected demographic coach and positive feelings of coach towards the child.
4. Consider each child as unique person, who will have its own treatment program, IEP (Individual Education Plan).
5. Emphasis on training and group interactions.
6. Exposure to child in the same group based on intellectual and cognitive level.
7. Use of rehabilitation services (speech therapy and occupational therapy), based on the needs assessment of each child, and using Sensory Integration(SI) and subjective approaches.
8. Emphasis on individual and group training classes every 15 days.
9. Emphasis on teaching and learning methods of HMTM for parents every 15 days.
10. Communication of ASD children with other groups of children affected to other disorders such as Down Syndrome, developmental disorders, speech disorders, cerebral palsy... with the aim of improving social communication and interaction in children.
11. Emphasis on mental evaluation and identify spots of brain damage, based on behavioral and cognitive functions for each child.
12. Emphasis on artistic skills in this children in order to identify talents, and approaching the peer group.
13. Emphasis on emotional development, with using individual games, group games and conceptual games.
14. Emphasis on understanding, generalization and improvement in speech perception.
15. Emphasis on modulation of sensory processing in order to improve function of the nervous system.

In this research the Childhood Autism Rating Scale (CARS) was used to assess the severity of symptoms in children. CARS is a behavior rating scale intended to help diagnose autism. The scale is used to observe and subjectively rate fifteen items.

- relationship to people
- imitation
- emotional response
- body
- object use
- adaptation to change
- visual response
- listening response
- taste-smell-touch response and use
- fear and nervousness
- verbal communication
- nonverbal communication
- activity level
- level and consistency of intellectual response
- general impression

Each of the fifteen criteria listed above is rated with a 7-point score. Lower scores indicate less severity of autism.

Table 5
Mean Scores CARS Subjects, At Baseline And Three Years After Treatment

CARS Score	**Mean**	**Standard Deviation**
Baseline	51.98	7.00
First Year	43.42	8.11
Second Year	37.00	9.12
Third Year	30.52	10.30

The results of this study showed that the severity of the symptoms of ASD after two years of HMTM treatment significantly reduced and after three years, reduced even further.

The Centers for Disease Control and Prevention (CDC) released data on the prevalence of autism in the United States in 2014. This surveillance study identified 1 in 68 children (1 in 42 boys and 1 in 189 girls) as having ASD (Autism Speaks, 2012). According to the CDC this data remained unchanged in 2016. With such a high

prevalence of ASD parents and families have found that effective medical approaches to treatment are lacking and have turned to alternative treatments.

This literature review focused on alternative and holistic treatments for behaviors typically seen in children with ASD. These treatments include: deep pressure, kinesthetics, diet, technology and other complementary and alternative medicines. In analyzing the studies there are many benefits to using natural and alternative means of treatment for children with ASD. However, the studies conducted are often found to be inconclusive or dependent on the individuals themselves. Autism spectrum disorder is just that, a spectrum of disorders which affects individuals in different ways. For this reason, one method of treatment will not work across all subjects with ASD. It has been recommended by many of the researchers that each case be taken as individual circumstance and all factors be taken into account when deciding which treatments are most effective for reducing negative behaviors often seen in ASD.

CHAPTER III: DISCUSSION AND CONCLUSION

Summary of Literature

Individuals with autism spectrum disorder (ASD) often have deficits in sensory processing, communication, social interaction and imagination. With the prevalence of ASD increasing, there has been an increasingly large amount of research evaluating ways to treat the negative behaviors often seen with ASD. For the purpose of this literature review, research studies in deep pressure, kinesthetics, diet, technology and other complementary alternative medicines (CAMs) were reviewed.

Deep pressure, also known as deep touch pressure (DTP), was first introduced by Temple Grandin as she described in her self-designed "hug machine." There are many different methods of deep pressure treatments including: weighted clothing/vests, swaddling, holding, stroking, hugging, squeezing and therapeutic brushing (Chen, 2013). A study conducted by Losinski et al. (2016) looked at the relative effects of DTP with students with disabilities across 23 research studies. Losinski (2016) found that many of the studies were generally low quality and the effects of DTP were relatively small. In another study conducted on a 14 yr old male with ASD, severe developmental cognitive disability (DCD) and Tourette's syndrome, the researchers used a weighted vest to attempt reduction of self injurious behaviors. The results of this study (Doughty & Doughty, 2008) showed that the subject, Ernie, did not necessarily benefit from the deep pressure treatment of the weighted vest. Rather, the positive effects shown were due to the weighted vest being a highly preferred item for Ernie. In Bestbier and Williams' study (2017) the overall effects of deep pressure appeared beneficial for most of the

participants. However, the effects were not uniform across all areas of functioning. Because of this, Bestbier and Williams (2017) suggest that deep pressure be tailored to the needs of the individual recipient.

Kinesthetics, embodiment and movement have also been studied as a means of alternative treatment for individuals with ASD. The first study (Hildebrandt et al., 2016) looked at the effects of dance movement therapy (DMT). The mean symptom reduction in this study was 15.27%, showing that DMT can have a positive effect in improving emotion expression. Another study developed by Rosenblatt et al. (2011) combined yoga, dance, and music therapy, based on the critical factors that elicit the relaxation response (RR) and examined its effect on the behavioral symptoms of children with an ASD. The results of this study suggest that a multimodal relaxation program have a positive impact on behavioral and cognitive symptoms in individuals with ASD based on the results of a combination of the BASC-2 and ABC assessments.

Diet is another highly studied approach to treating symptoms of ASD. Scientists began noticing a correlation between ASD and gastrointestinal problems as early as 1971 (Ferro & Prasad, 2016). Many studies have found that children with ASD have similar intestinal characteristics of those with Crohn's disease and ulcerative colitis. For this reason, researchers are able to look at dietary treatments for Crohn's and colitis and determine if they would be appropriate for children with ASD. The similar intestinal characteristics include a less diverse microbiome, an unbalanced microbiota and increased intestinal permeability (Ferro & Prasad, 2016). Decreasing or eliminating the intake of certain carbohydrates, lactose and sugars has been shown to shift the

composition of the intestinal microbiome which improves overall intestinal functioning. Ferro & Prasad (2016) recommend that in terms of dietary restrictions for children with ASD that elimination of casein is also considered. Casein refers to dairy products including: breast milk, yogurt, cheese, butter, cream, ice cream and so on. A gluten free, casein free (GFCF) diet is common amongst families attempting to reduce negative behaviors in their children with autism. In order to for this type of diet to be feasible, families must show a great deal of commitment while being careful not to consume "hidden" dairy and gluten. In a study completed by Marí-Bauset et al. (2015) not only has this diet not shown a decrease in negative behaviors, it has shown that children on a GFCF diet are likely to have a lower weight, BMI and total energy intake than those on a regular diet. Another GFCF study completed by Hyman et al. (2016) did not detect an impact of dietary restrictions on behaviors of those with ASD. Hyman (2016) states that those studies that show positive effects of GFCF diets often take place over a long period of time where the children with ASD are also receiving treatments outside of the dietary restrictions. In the studies for this literature review, the researchers suggested that dietary restrictions for the use of reducing negative behaviors in children with ASD be individually investigated in order to make informed decisions on a case-by-case basis.

Technology is another alternative treatment for behaviors associated with ASD. Many students with ASD struggle with motivation and follow through in a typical or formal education setting. Computer games can mix various active learning strategies such as role-play, discussion, collaborative learning activities, small group discussion, reading and writing and speaking. Moradi (2017) conducted a study where computer games were

used to teach math. The treatment group showed significant improvement on their posttest scores in comparison to the control group. Another way in which technology can benefit students with ASD if through prosocial video gaming. Students in the Blum-Dimaya (2010) study learned to play Guitar Hero II™ by following a photographic activity schedule and on screen video modeling. This study showed that students were able to learn an age appropriate game and also generalize the skill into areas outside of the teaching environment. Students with ASD often struggle with social interactions and communication making it difficult for them to increase their leisure skills. Games and technology have shown to be a beneficial way to help motivate these students with school work and also provide prosocial opportunities.

There are a variety of other complementary and alternative medicines (CAMs) which were reviewed for the purpose of this literature review. There is very little research available about the use of medical marijuana to treat negative symptoms associated with ASD. However, some researchers and parents have seen a decrease in aggressive and violent behaviors with the use of marijuana. Researchers state that THC can affect certain receptors in the brain, releasing oxytocin which results in less anxiety and more positive social behaviors in people with ASD. Another study looked at the use of other CAM therapies and their perceived effectiveness according to parents and caregivers. The most frequently used treatments were multivitamins, GFCF diet and methyl B-12 injections. The CAM therapies with the highest average rating of perceived effectiveness were sensory integration therapy, melatonin, and the off-label use of prescription antifungal medications (Hopf et al., 2016).

Other interventions include early, intensive behavioral interventions such as ABA and TEACCH. The Holistic Multidimensional Treatment Model (HMTM) was examined with more detail for the purpose of this literature review. Using the Childhood Autism Rating Scale (CARS) which rates children with ASD in 15 different areas, HMTM has shown to effectively reduce symptoms in children with ASD. The study completed by Hojjati (2014) examined the results over a span of three years. The results show an increasing reduction in symptoms over the span of the three years.

Limitations of the Research

Losinski et al. (2016) describes a number of limitations within the meta-analysis regarding deep pressure therapies. First, with regard to study quality, CEC's (2014) guidelines were relatively new, and studies may not have included certain items due to a number of factors (e.g., page limitations) rather than not collecting the information. Second, a variety of effect sizes were utilized, each with their own unique limitations, so conclusions drawn from them should be done with caution. Third, this analysis was limited to dependent variables that had direct implications for the education of students with disabilities and therefore could have overlooked uses in non-educational contexts. Finally, it is possible that these techniques work on a level that is difficult to measure, and could provide a calming effect that our measurement systems cannot detect. Consideration should also be given to how deep pressure could be used to improve behaviour. If it is rewarding, then people might show more challenging behaviour in order to obtain deep pressure. In the study conducted by Bestbier and Williams (2017), the researchers state that the variability of responses to deep pressure may be of

importance. All participants showed a wide range of improved behaviors (calmness, responsiveness, engaged, communicative etc). Also the participants' overall demeanor may affect their responsiveness to DTP. Not all participants benefit to the same extent, which suggests that more research is needed to define the populations who may benefit most (Bestbier & Williams, 2017).

In regards to the kinesthetics portion of this literature review, Hildebrandt et al., 2016 state multiple limitations with this study. First being the dyadic mirroring portion of the study, which was predominantly performed in dyads of two participants with ASD rather than one participant and one co-therapist. This intervention aims to strengthen perception of others' emotions by mirroring their movements. It would be crucial that the partner displays emotions in a non-autistic manner. In addition the SANS rating were conducted by trained student apprentices, ideally this would have been completed by more experienced raters. In the Rosenblatt et al., 2011 study, not enough data was obtained from subjects to what degree they practiced the yoga and dance interventions at home. Also a relationship was not found between the number of sessions attended and treatment outcome. This suggests that treatment factors other than attendance could have led to the results.

Marí-Bauset et al. (2014) state that limitations within their study on diet include a relatively small sample size, which limits the statistical power to identify difference between groups. The researchers also recognize their study was limited by the parents' ability recognize and be aware of dairy content in foods given during the study. In addition, information on the labels of packaged foods is not 100% reliable, and there

could be as yet unknown errors in the data on nutrients in the computer program used for processing the data (Marí-Bauset et al., 2014). Hyman et al. (2016) state that the most notable limitation in their study was the small sample size. The researchers struggled to recruit participants for the study, despite the popularity of the GFCF diet. In addition the rigor of the diet and study protocol was a substantial barrier (Hyman et al., 2016). Only 14 of the 22 enrolled participants and their families successfully implemented the diet and collected data. Moreover, some of these 14 participants missed one or more challenges or had other missing data. The small sample size limits interpretation and generalizability of findings. Hyman (2016) also states that some proponents of the diet might take longer than the 4-6 weeks to take full effect. In addition, this study focused solely on removing gluten and casein from children's diets but no other items (corn or soy) as other researchers have done in the past. Additionally they excluded participants who had known gastrointestinal disorders, who may have been more likely to respond positively to dietary restriction.

Limitations of the Blum-Dimaya et al. (2010) study include that the leisure skills taught may be of limited utility for younger learners. The motor skills needed to play this particular video game may be difficult for less developed hands and fingers. Another limitation is that the researchers never tested the participants' ability to play the game outside of practice mode. It is unknown whether they would be able to play the game during a more typical "competitive" mode of the game which would be more realistic when playing with peers.

Within the study completed by Hopf et al. (2016) limitations are that the type of CAM therapies used are often marketed by companies seeking to capitalize on parents' fear and confusion surrounding their child's diagnosis of ASD. These companies may make false claims about unregulated products. The sparsity of peer-reviewed, well-controlled, independent studies about CAM therapies may impair the parents' ability to make a well informed decision about the appropriateness of a treatment. In addition to these inconsistencies surrounding CAM therapies, the participants of this study all had ASD per a report by the parents. It is unknown as to which DSM criteria were used for the diagnosis. Sample size within this study was also fairly small and most self-identified as white so there is not a significant representation of the experiences of other racial and ethnic groups.

Implications for Future Research

Research around ASD and alternative medicines and therapies is lacking overall in any sort of conclusive results. For many of the studies, the results were inconclusive due to the vast individualities between children with ASD. Most of the studies suggested continuing the research with more specific participant samples.

Discussing future research in the area of sensory-based therapies is difficult as so many previous studies have found limited efficacy in these therapies. Losinski et al. (2016) states that for future research in this area, we must ask whether it's possible to predict which individuals will benefit from the interventions. There are a number of measures of sensory sensitivity and processing that are believed to predict response to

sensory stimulation and which could be evaluated. Research should be designed to study each sensory-based therapy individually based on individual preference.

Within the kinesthetics and movement studies included in this literature review it would be interesting to examine whether symptom reduction was only due to general properties of physical and/or group activities or to specific properties postulated as effective by the notion of embodiment. Within the Rosenblatt et al., 2011 study, other measures of patient engagement will need to be included as well as home practice in order to determine whether degree of participation in the program was a key variable in the effects found.

Less than a decade ago, dietary interventions for Crohn's disease and ulcerative colitis were ignored by the mainstream medical community. Now we are seeing positive therapeutic application of diets such as the SCD at major hospitals (Ferro & Prasad, 2017). The use of a casein-free SCD diet, or other diet, for ASD may follow a similar trajectory. For future studies looking at dietary restrictions in children with ASD, it is suggested that researchers look more specifically at which behaviors are in need of alteration or reduction and also which (if any) gastrointestinal diseases are already prevalent in the study samples. With so many individual dietary traits, like most studies, it is important to implement treatment on a case-by-case basis.

Future research around technology and video games may investigate the use of a training package similar to the one used in the Blum-Dimaya et al. (2010) study. The training package could also be adapted to investigate the use of written activity schedules for participants who demonstrate prerequisite reading skills. Additional studies may also

look into optimal ways to phase out the activity schedules based on specific criterion levels such as when to fade, direction to fade (removing pictures from front to back or back to front) and how to fade systematically (Blum-Dimaya et al., 2010).

Professional Application

I have been working with individuals with ASD for approximately 10 years. Though I do not currently have a teaching license in autism spectrum disorders, I have spent a lot of time learning about, witnessing and implementing a wide variety of treatments and therapies for these individuals. As a personal care assistant, I had 4 year old client with severe ASD. He was tube fed and received 40 hours per week of intense ABA therapy. His parents were determined to "cure" his autism. Another client I worked with was a 23 year old female with mild/moderate developmental cognitive disability (DCD) and ASD. She received sensory integration therapy, swimming therapy and also completed a series of "Me Moves" exercises in order assist with self-regulation. Now, working in a school setting, I have students who utilize sensory integration exercises, fidgets, foods (gum/mints), assistive technologies etc. The school I work in currently has a 40% special education population and is extremely accommodating to all students. It seems like every student has their own form of alternative treatment or therapies that work for them. This made me wonder, which of these are scientifically proven to regulate students with autism and which are simply prefered activities which account for behavior changes.

I was surprised to find that deep pressure therapy was generally ineffective in terms of sensory-integration therapy. Instead, it seemed to be more of a preferred activity

which would alter behaviors and in a sense, help regulate a student. I see this with my students and it's difficult to determine whether the deep pressure therapy is regulating them or if it's the quiet and calming environment where these activities take place that is helping them refocus. Maybe it's the combination of both, maybe it doesn't matter so long as they are happy, calm and ready to focus.

I would like to include more opportunities for movement or kinesthetic breaks for my students at school. I found these studies to be fascinating and overall effective. Many of my students struggle with anxiety in a variety of different environments. The embodiment, movement, yoga, mindfulness and music therapies have shown to reduce anxiety and irritability in the Rosenblatt (2011) study. Currently my students use the school's sensory room for a variety of activities which help them to regulate. These activities include: punching a heavy bag, tossing medicine balls, and other physical activities like push-ups, jumping jacks and sit-ups. The students leave the sensory room appearing well regulated, focused and ready for classes. Those who can verbally express the way they feel, are able to tell me in what ways the physical movement helps them.

Diet is not something that can be entirely implemented in school, this method of treatment needs to be strictly implemented throughout all environments of a student's day (home, school etc). It's difficult to know for sure if the GFCF diet is effective in reducing symptoms of ASD or if people with ASD have a weakened gastrointestinal system causing discomfort and irritability which are lessened by this restricted diet. This method of alternative treatment is one that really needs to be considered on a case by case basis due to potential malnutrition or allergy implications.

Technology has been a great tool for students with ASD. I use a variety of technology within my classroom currently: assistive technology such as voice to text dictation and touch screen applications to games and online curriculum which meet students' needs and accommodations. In addition to assisting students in academics, I have witnessed technology and games create prosocial opportunities within my classroom. Based on the studies conducted as part of this literature review, I think technology and games should continue to be utilized in the special education classrooms for students with ASD.

Amongst the other complementary alternative medicines examined as part of this literature review, I think the Holistic Multidimensional Treatment Model (HMTM) would be most effective to implement in my classroom. While reviewing the research of this treatment model, it sounds a lot like the way I treat and interact with my students already. By looking at the entire student and focusing on relationships and connections, we are able to be more effective in teaching these students. Approaching a student or a situation with the whole student in mind will result in a much more effective teacher, student relationship.

I don't believe that we can point to one form of therapy or one treatment method from this literature review and say that it's going to be effective with all individuals with ASD. Each student (with or without ASD) needs to be evaluated as an individual and methods of treatment or therapies should be implemented accordingly. In the end, I started to wonder if it truly matters which methods are scientifically proven to reduce symptoms of ASD or if the student's quality of living and overall state of happiness what

matters most when looking at what treatments and therapies are utilized throughout their day. While some have proven through research to be effective, it is the combination of all aspects of a student's life which will determine their abilities to regulate and be successful.

Conclusion

Autism spectrum disorder is very complex. There are many different approaches to try when working with a child with ASD. Because it is a spectrum disorder, the severity and prevalence of symptoms will differ from individual to individual. Due to the varying degrees of this disorder and symptoms, it is best to try multiple methods of regulation and treatment.

Deep pressure or sensory integration therapies may be used to benefit children with ASD in ways that calm anxieties of the child. However caution should be used with these types of therapies when children exhibit negative behaviors in order to receive a desired sensory treatment. The variability in individual responses within all studies included for this literature review indicate that the deep pressure therapies should be tailored to the needs of each recipient.

Yoga, embodiment and multimodal relaxation programs proved to have a positive influence on behavior in regards to irritability. Participants in these studies showed less anxiety and an improvement in emotion expression.

Diet may be one of the most misleading methods of treatment for negative behaviors in ASD. While some studies show positive effects of a GFCF diet, there is very little evidence to determine if the positive effects are due to ASD or other gastrointestinal

diseases. While to two are often linked, further research is needed to determine whether or not dietary restrictions are proven to decrease negative behaviors in children with ASD. Similar to the deep pressure therapies, individual responses vary greatly with dietary restrictions and each decision should be made on a case-by-case basis by taking all of the child's nutrition into consideration.

Technology is another beneficial means to motivate students with ASD within a formal classroom as well as to teach prosocial, age appropriate leisure activities. Students who use games and technology as part of curriculum have shown an improvement in testing scores. In addition, by teaching students with ASD age appropriate video games (using photogenic activity schedules and video modeling) students are able to interact with peers in a prosocial and age appropriate manner.

The use of complementary and alternative medicines (CAM) is very popular amongst families with children with ASD. Many of these studies require additional resources and education on the part of the families which makes them inaccessible to all. A few examples of other CAMs available are: vitamin supplements, bodywork (massage), detoxification, hormone therapies, antifungal medications, herbal therapies and other therapies such as music, sensory and auditory integration therapies.

While there are many studies available discussing alternative methods of treatment for ASD behaviors, there is still a ways to go. When exploring alternative treatments for ASD it is best to take a holistic approach and keep the child's individual behaviors and needs in mind. While many of these studies have been proven (in some way) to benefit children with ASD, it's best to keep in mind the combination of therapies

and treatments, the age of the child and the purpose of the treatments and therapies being examined.

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