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Occupational Therapy Feeding and Eating Interventions for Autism Spectrum Disorders and Pervasive Developmental Disorders: A Systematic Review

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Occupational Therapy Feeding and Eating Interventions for Autism Spectrum Disorders
and Pervasive Developmental Disorders: A Systematic Review

by

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This Scholarly Project Paper, submitted by Jordan T. Adolf and Hana M. Mattern in partial fulfillment of the requirement for the Degree of Master of Occupational Therapy from the University of North Dakota, has been read by the Faculty Advisors under whom the work has been done and is hereby approved.

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Title Occupational Therapy Feeding and Eating Interventions for
Persons with Autism Spectrum Disorders and Pervasive
Developmental Disorders: A Systematic Review

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ABSTRACT

Due to the limited evidence and lack of methodological rigor regarding feeding and issues in children with Autism Spectrum Disorders (ASD) and Pervasive Developmental Disorders (PDD), clinicians who treat children with these diagnoses rely on the limited amount of information and many are not aware of evidence-based interventions (Ahearn, Castine, Nault, & Green, 2001; Marshall, Hill, & Dodrill, 2013). The purpose of this scholarly project is to gather, critique, and determine efficacy of occupational therapy feeding and eating interventions for children with ASD and PDD.

We systematically reviewed literature for higher-level evidence, as defined by Level III evidence or above, in regards to occupational therapy feeding and eating interventions for children with ASD and PDD in studies that were published between January 2000 and December 2015 and located in PubMed, OT Search, Cumulative Index of Nursing and Allied Health Literature (CINAHL), and the American Journal of Occupational Therapy (AJOT). Our search yielded a total of 7,189 titles and abstracts that were narrowed through the screening process to 27 articles for review. The secondary review resulted in 11 articles, which received a full-text review. A total of 9 articles were found to meet inclusion criteria and be appropriate for critical appraisal. The results of these articles were compiled in an evidence table and a systematic review manuscript was specifically written for the AJOT.

Our scholarly project highlights the various discrepancies regarding research for

occupational therapy feeding and eating interventions for children with ASD and PDD. Recommendations for future research and implications for occupational therapy practice include the need for higher-level evidence to support the practice of occupational therapy practitioners and the development of a specific protocol to standardize occupational therapy treatment for feeding and eating difficulties among children with ASD and PDD.

Chapter I

Introduction

Feeding and eating difficulties have been well documented in the literature for children with Autism Spectrum Disorders (ASD) and Pervasive Developmental Disorders (PDD); however, the exact prevalence of these issues is relatively unknown. The diagnostic criteria for children with ASD and PDD include persistent deficits in social communication and social interaction skills, restrictive and repetitive patterns of behavior, and clinically significant problems in various areas of functioning (American Psychiatric Association, 2013). Children with ASD often eat fewer foods from each of the main food groups, eat a narrow range of foods presented to them, and display a variety of abnormal feeding patterns (Ahearn, Castine, Nault, & Green, 2001; Laud, Girolami, Boscoe, & Gulotta, 2009; Provost, Crowe, Osbourn, McClain, & Skipper, 2010). Due to the limited evidence and lack of methodological rigor regarding feeding and eating difficulties in children with ASD and PDD, occupational therapy practitioners rely on the limited amount of information and are not aware of evidence-based interventions (Ahearn et al., 2001; Marshall, Hill, & Dodrill, 2013).

The role of occupational therapy is to provide opportunities for children to participate in their everyday occupations, or meaningful daily activities needed to function, including feeding and eating (American Occupational Therapy Association

[AOTA], 2014). Occupational therapy practitioners address feeding and eating by incorporating a variety of different techniques, including sensory approaches, systematic desensitization, operant conditioning, and other oral motor learning strategies (Cermak, Curtin, & Bandini, 2010; Howe & Wang, 2013; Marshall et al., 2013). Despite occupational therapy's established role in the care of these children and their families, research has been inconsistent in regards to the overall effectiveness of the intervention approaches. Further research is needed to justify the care being provided, establish the unique value of occupational therapy, and contribute to evidence-based practice for the profession as a whole (AOTA, 2014).

In order to address the lack of research in this area, the purpose of this scholarly project is to gather, critique, and determine efficacy of occupational therapy feeding and eating interventions for children with ASD and PDD. To accomplish this, a comprehensive combination of terms guided the search process, including feeding, eating behaviors, Autism Spectrum Disorders, Pervasive Developmental Disorders, occupational therapy, and occupational therapy interventions. This systematic review is atheoretical in nature due to the compilation of articles in which authors use a variety of models, theories, and frames of reference to guide their clinical research. It is anticipated the results of this study will increase the efficacy of feeding and eating interventions in occupational therapy practice for children with ASD and PDD and provide future directions for research.

Chapter II provides a review of the existing literature in regards to feeding and eating difficulties in children with ASD, PDD, and typically-developing children. Chapter III consists of the processes we used to complete this scholarly project, from

conception to completion. Chapter IV consists of a brief summary of the product, which is a manuscript that was specifically written for submission to the American Journal of Occupational Therapy (AJOT) and includes the significance of the results in addressing the lack of feeding and eating occupational therapy interventions in the literature. The manuscript is located in the appendices. Chapter V is comprised of a summary and overview of the project, including limitations, conclusions, future directions, and implications for occupational therapy practice.

Chapter II

Literature Review

There is currently limited knowledge in regards to feeding and eating interventions for children with Autism Spectrum Disorders (ASD) and Pervasive Developmental Disorders (PDD) (Marshall et al., 2013). Feeding and eating issues have been subjectively reported in this population of children, creating a need for interventions to address these issues (Ahearn et al., 2001). The lack of evidence and knowledge available limits the ability of occupational therapists and other clinical providers to provide effective, evidence-based interventions for this population. Occupational therapists typically use theories, models, and frames of reference to guide clinical reasoning and decision-making in practice. This systematic review is atheoretical in nature due to the compilation of articles in which authors use a variety of models, theories, and frames of reference to guide their clinical research. It is anticipated the results of this study will further the evidence for consistent and effective feeding and eating interventions for children with ASD and PDD.

The diagnostic criteria for children with ASD, according to the *Fifth Edition of the Diagnostic and Statistical Manual of Mental Disorders* (DSM-5), includes persistent deficits in social communication and social interaction skills, restrictive and repetitive patterns of behavior, and clinically significant problems in various areas of functioning (American Psychiatric Association [APA], 2013). The diagnosis of PDD is included

within the definition of ASD as a result of the changes made in the DSM-5 (APA, 2013). Other researchers have defined these behaviors as impairments in flexibility and restricted patterns of interest (Koegel et al., 2012); however, each child varies in the severity and type of symptoms displayed, making these behaviors difficult to measure objectively.

Some researchers have also found sensory processing differences in children with ASD and PDD, including preferences for certain, foods, textures, and tastes (O'Donnell, Deitz, Kartin, Nalty, & Dawson, 2012). Children with ASD often respond to sensory experiences in unusual and maladaptive ways that cause problems for them in all areas of functioning (Brown & Dunn, 2010). According to Tomchek and Dunn (2007), most children with ASD (95%) display sensory processing difficulties to some degree. Most often, they are seeking additional sensory input, avoiding sensory input, are sensitive to sensory input, or have difficulty registering sensory input and may miss certain sensory experiences due to the variability in their threshold for experiencing senses in their day to day lives (Brown & Dunn, 2010). These tendencies for sensory input carry over into all aspects of daily life, including bathing, eating, dressing, play, and social interactions both in the home environment and in the community.

Children with ASD and PDD may experience auditory processing difficulties, visual processing difficulties, tactile processing difficulties, as well as attentional and arousal difficulties. These sensory processing difficulties lead to maladaptive and problematic behaviors that disrupt all activities of daily living and meaningful occupations, which are relevant topics and areas for intervention for occupational therapists who typically work with this population. Feeding and eating problems may be

common in children with ASD, PDD, and other developmental disabilities; however, methodological rigor has been lacking in the research on the topic of feeding difficulties and this population of children (Ahearn et al., 2001).

Feeding and Eating Behaviors in Children with ASD and PDD

Feeding and eating difficulties have been well documented in the literature for children with ASD and PDD; however, the exact prevalence of these issues is relatively unknown. Feeding problems are typically defined by an abnormal pattern of oral or enteral consumption of nutrients that lead to negative social or health consequences (Laud, Girolami, Boscoe, & Gulotta, 2009). Mothers have reported feeding and eating problems as early as when they were breastfeeding their children. Provost, Crowe, Osbourn, McClain, and Skipper (2010) reported that 47% of mothers had difficulty when breastfeeding their children with ASD. Additionally, these feeding and eating impairments continued through the age of three. Nadon, Feldman, Dunn, and Gisell (2011) found similar results in that children with ASD, in comparison to their typically developing siblings, had more eating problems reported as infants. Despite this, older children tended to have less eating problems than younger children (Nadon et al., 2011). Although the current research has limited use of systematic, objective evaluations to measure the prevalence and nature of feeding patterns and children with ASD (Ahearn et al., 2001), a vast array of information for this topic is available.

Children with ASD have been found to have inflexible eating patterns, including consuming a restricted amount of foods (Koegel et al., 2012; Marshall, Ware, Ziviani, Hill, & Dodrill, 2014); preferences for foods high in carbohydrates, sugars, and salt; pica; preferences for specific textures, temperatures, colors, and cravings (Ahearn et al., 2001;

Marshall et al., 2014; Nadon et al., 2011; Provost, Crowe, Osbourn, McClain, & Skipper, 2010; Wang, Tancredi, & Thomas, 2011). Narrow diets found in children with autism could be an extension of the characteristic restriction in interests and activities (Williams & Seiverling, 2010). According to Schmitt, Heiss, and Campbell (2008), boys with autism consume significantly less variety of foods, and choose food based on texture 70% of the time. Researchers have also identified abnormal patterns when children were allowed to feed themselves, including food refusal, food type selectivity, and food texture selectivity (Ahearn et al., 2001; Laud et al., 2009; Provost et al., 2010). In addition, children with ASD have presented with feeding difficulties in the form of extreme fear of new foods, food refusal, coughing/gagging, vomiting, choking, drooling, and a tendency for being overweight (Laud et al., 2009; Marshall et al., 2014; Nadon et al., 2011). Children with ASD often eat fewer foods from each of the main food groups, eat a narrow range of foods presented to them, and put non-food items into their mouths (Provost et al., 2010). Almost 15% of children with ASD were found to have difficulties with chewing, moving their tongue, or swallowing (Nadon et al., 2011). More behaviors displayed by children with ASD included refusing to sit at the table, having recurrent temper tantrums, throwing or dumping food on the floor, requiring specific utensils and food presentations, gagging when presented with food, and simply being picky eaters in general (Nadon et al., 2011; Provost et al., 2010).

The onset and persistence of feeding problems is influenced by multiple factors and varies between children depending on the causes or maintaining factors from physiological dysfunctions to inappropriate reinforcement of behavior during feeding (Laud et al., 2009). These specific food preferences and behaviors may be due to tactile

and visual processing difficulties reported in children with ASD, as they may have certain aversions to foods depending on texture, taste, and look (Tomchek & Dunn, 2007). Occupational therapists have reported problems with picky eating due to tactile defensiveness in children with ASD (Smith, Roux, Naidoo, & Venter, 2005). With limited communication and social interaction skills, children with ASD may display increased picky eating and food preferences due to the inability to report on gastrointestinal discomfort or produce an adaptive response. Children with ASD had significantly more gastrointestinal issues than their typically developing siblings, including constipation, diarrhea, vomiting, abdominal bloating and pain, food selectivity, food regurgitation, gastroesophageal reflux (GER), and food intolerance (Wang et al., 2011). Interestingly, Wang et al. (2011) found that with increased severity of ASD and PDD features, children had a correlational increase in the presence of gastrointestinal problems. Nadon et al. (2011) found that children with ASD took more medications for these issues and had more medical problems than their typically developing siblings, highlighting the influence of feeding, eating, and other associated symptoms on daily life for this population.

Comparison to Feeding and Eating Behaviors in Typically Developing Children

Overall, researchers have found that children with ASD, PDD, and other developmental disabilities have different feeding and eating patterns than their typically developing peers and present with more disruptive mealtime behaviors (Martins, Young, & Robson, 2008; Provost et al., 2010); however, further research is warranted to determine if feeding difficulties are characteristic solely to children with ASD or if abnormal levels of difficulties exist in children with any type of developmental delay

(Ahearn et al., 2001). It is unclear whether or not feeding difficulties for children with autism are different from typically developing children due to the large amount of anecdotal evidence from parent report found in the existing literature (Martins et al., 2008). Schrek, Williams, and Smith (2004) conducted one of the first studies comparing children with ASD and typically developing children in regards to eating behaviors. Results confirmed previous research findings that the eating behavior of children with ASD is restricted by food category and increased food refusal compared to typically developing children.

Provost et al. (2010) found that typically developing children ate significantly more foods with no feeding and eating difficulties. In addition, children with ASD had significantly more difficulty eating at restaurants and school in comparison to their peers (Provost et al., 2010), indicating the importance of context and location in relation to eating as well. Inconsistent results in the literature have shown that increased picky eating behavior and poor self-feeding skills were only marginally more present in children with autism in comparison to their typically-developing siblings; furthermore, children with autism were more likely to avoid foods and exhibit a fear of new foods (Martins et al., 2008). The lack of using a comparison group makes it difficult to distinguish if the high prevalence of selective eating is unique to those children with ASD or if typically developing children have the same prevalence (Cermak, Curtin, & Bandini, 2010); however, 67% of children with ASD and 33% of the typically developing children were experiencing feeding problems prior to being participants in a study done by Martins et al. (2008). Nadon et al. (2011) examined children with ASD and their nearest age sibling without a diagnosis of ASD and found that the child or children with ASD had

significantly more difficulty with mealtime and needed more supervision (Nadon et al., 2011; Marshall et al., 2013). The discrepancies in these results lead to the need for further research in this population, because no widespread explanation exists (Laud et al., 2009).

Influence of Feeding, Eating, and Other Associated Symptoms on Daily Life

ASD may have a lifelong impact on activities of daily living due to abnormal or impaired developments in social interaction and restricted patterns of behavior (Marshall et al., 2013). As previously mentioned, children with ASD have been found to have significantly more impairment in relation to sensory processing and have difficulty forming an appropriate adaptive response in these difficult circumstances (Tomchek & Dunn, 2007). For example, when presented with a food the child does not like, he or she may scream, hit, kick, etc. instead of responding, “no, thank you” due to the inability to form an adaptive response to the stimulus. These feeding and eating behaviors affect all other areas of functioning not only for the children themselves, but also for the family members trying to address these concerns (Provost et al., 2010). In addition, these children may be having increased difficulty in school, especially during lunch and/or snack times, and also with their peers. Sensory aversions, such as oral defensiveness and tactile defensiveness, may negatively influence eating (Cermak et al., 2010), and further alienate these children from their typically developing peers.

In order for these needs to be addressed, occupational therapists need to be aware of the parental concerns, difficulties, and day-to-day struggles experienced with these children during mealtimes (Nadon et al., 2011; Provost et al., 2010). It was reported that 52% of children with ASD always or often needed a different meal during mealtimes with family, creating extra work and a stressful atmosphere at most mealtimes for the

child, parents, and siblings (Nadon et al., 2011). Likewise, Cermak et al. (2010) found that increased stress resulted from sensory-based feeding issues, which negatively impacted family mealtimes and overall quality of life. This stressful atmosphere influences other environments, such as school and community settings. According to Gale, Eikeseth, and Rudrud (2011), functional assessment within the child's natural setting can be used to determine appropriate treatment and to incorporate parents as team members for children with a diagnosis of ASD and PDD.

Occupational Therapy Practice Framework and the Role of Occupational Therapy

Occupational therapists are a vital team member in providing feeding and eating interventions for children with ASD and PDD. To guide their clinical decision making during practice, occupational therapists utilize the *Occupational Therapy Framework: Domain and Process, 3rd edition (OTPF-3)* (American Occupational Therapy Association [AOTA], 2014). The role of occupational therapy is to provide opportunities for children to participate in their everyday occupations, or meaningful daily activities needed to function (AOTA, 2014). Activities of daily living (ADLs) is one area of occupation that occupational therapists address and encompass activities such as bathing, dressing, feeding, swallowing/eating, etc. According to AOTA (2014), feeding is defined as “setting up, arranging, and bringing food [or fluid] from the plate or cup to the mouth; sometimes called *self-feeding*” (p. S19). Swallowing/eating is defined as “keeping and manipulating food or fluid in the mouth and swallowing; *swallowing* is moving food from the mouth to the stomach” (p. S19).

The occupational therapy process begins with evaluation of the child, which includes collecting information for an occupational profile and analyzing occupational

performance through observation of the child during mealtime or using standardized assessments (AOTA, 2014; O'Donnell et al., 2012). Occupational therapists then use this information to plan and provide individualized interventions while targeting specific outcomes and goals determined by the occupational therapist, the family, and the child (AOTA, 2014). Occupational therapy practitioners use short- and long-term goals to address feeding difficulties in children, such as establishing a developmental sequence of self-feeding skills, improving acceptance of a wide variety of food and textures, or improving oral-motor skills (Howe & Wang, 2013). In addition, occupational therapy practitioners typically apply techniques to improve the mechanics of feeding or promote feeding interaction between the child and his/her primary caregiver (Howe & Wang, 2013). Practitioners can attempt to alleviate worry in parents and caregivers and decrease eating and feeding difficulties by disclosing information about the normalcy of feeding difficulties in both children with autism and typically developing children (Martins et al., 2008). Occupational therapy practitioners can also use sensory integration approaches, including programs, stories, and strategies, to reduce the child's sensory defensiveness in relation to feeding and eating (Cermak et al., 2010). Systematic desensitization was most commonly reported by practitioners followed by operant conditioning programs to address feeding difficulties in children with ASD (Marshall et al., 2013). Despite these attempts to decrease maladaptive mealtime behaviors, research has been inconsistent in regards to the overall effectiveness of the intervention approaches.

Occupational therapists play a critical role in the care of children with ASD and PDD; however, they are only part of a team involved in the care of these children. An interdisciplinary approach is recommended to address atypical eating patterns in children

with ASD (Cermak et al., 2010), including occupational therapists, dieticians, speech-language pathologists, behavioral psychologists, family members, etc. Nadon et al. (2011) pointed out that maladaptive feeding and eating behaviors that children with ASD display may be more challenging to address and change for the long term due to their resistant and rigid patterns of thinking and behavior; therefore, an interdisciplinary team with a variety of approaches will help alleviate the wide range of issues associated with ASD and PDD. Speech-language pathologists are most commonly addressing feeding difficulties with the ASD population in Australia (Marshall et al., 2013). Other disciplines are needed as well because nutritional counseling is critical when a child with ASD is working on increasing acceptable foods to ensure nutritional adequacy in every bite the child consumes (Cermak et al., 2010). Occupational therapists also bring in behavioral interventions, parent-directed and educational interventions, and physiological interventions (Howe & Wang, 2013).

Purpose of this Study

Due to the limited evidence and relatively unknown prevalence of feeding and eating issues in children with ASD and PDD, clinicians who treat children with these diagnoses rely on the limited amount of information to treat their patients (Marshall et al., 2013). Many occupational therapists are not aware of evidence-based interventions to effectively address these feeding and eating behaviors. In fact, no evidence-based practice guidelines currently exist for addressing feeding difficulties in children with ASD. Furthermore, no consistent practices across facilities exist for addressing these concerns (Marshall et al., 2013). The occupational therapy literature would benefit from an increased number of studies with rigorous designs in specific populations to examine

the effectiveness of specific techniques for addressing feeding difficulties (Cermak et al., 2010; Howe & Wang, 2013; Marshall et al., 2014; Martins et al., 2008; Nadon et al., 2011; Tomchek & Dunn, 2007; Wang et al., 2011).

One study in particular, Marshall et al. (2014), exemplifies how few systematic reviews have been conducted on interventions for children with ASD and feeding difficulties and how the quality of research reviewed has been weak. Marshall et al. (2014) specifically looked at the effectiveness of feeding and eating interventions for this population; however, they did not examine the role of occupational therapy in these interventions. Occupational therapy practitioners are being consulted on a daily basis for feeding difficulties with this population to provide appropriate interventions. There is a need for research specific to the occupational therapy profession in order to justify the care being provided to these patients and their families rather than other professions. In addition, more research on ASD and feeding difficulties will result in more focused and effective interventions for practitioners, as well as provide evidence-based practice for the occupational therapy profession as a whole (AOTA, 2014; Cermak et al., 2010).

The purpose of this scholarly project is to systematically review the current evidence to determine appropriate and effective occupational therapy interventions to address feeding and eating problems for clients with ASD and PDD. Chapter II consisted of a review of the existing literature in regards to feeding and eating difficulties in children with ASD, PDD, and typically-developing children. Chapter III consists of the conceptualization and development of this scholarly project.

Chapter III

Methodology

Chapter III consists of the processes we used to complete this scholarly project, from conception to completion. The topic was conceptualized by examining our broad past experiences and interests within the pediatric population. We identified gaps in the literature when conducting preliminary research about children with Autism Spectrum Disorders (ASD) and Pervasive Developmental Disorders (PDD), obesity in children, sensory processing difficulties, feeding and eating interventions, and the role of family in mealtime. Through further research and discussions with our graduate research advisors and two research and education librarians, we created a more focused question for this systematic review regarding feeding and eating interventions. Prior to the literature review, the eight stages of systematic review and meta-analysis were reviewed (Uman, 2011) as well as systematic review information authored by Hemingway and Brereton (2009).

Research Design and Procedures

We conducted a thorough literature review on topics relating to feeding methods, eating behaviors, food habits, ASD, PDD, and occupational therapy interventions and services. First, we reviewed the titles and abstracts for preliminary inclusion and exclusion criteria. Next, we reviewed articles related to occupational therapy interventions, and then utilized two research and education librarians to determine

feasible search terms through a second preliminary search. We systematically reviewed literature for higher-level evidence to determine which occupational therapy feeding and eating interventions have been found to be consistent and effective for persons with ASD and PDD within the past 15 years. The search strategy included a title and abstract review of PubMed, OT Search, CINAHL, and the AJOT for items published between January 2000 and December 2015. The following Medical Subject Headings (MeSH), subject terms, and keywords were identified and exclusively used during our search:

feeding, feeding methods, feeding behaviors, eating, eating behaviors, Autism Spectrum Disorders, autism, autistic disorder, Pervasive Developmental Disorders, occupational therapy, occupational therapy interventions, and occupational therapist. In addition, we obtained direction from the librarians and reviewed previous studies regarding inclusion and exclusion criteria prior to finalizing the criteria for this study. Our graduate research advisors also consulted on article inclusion and exclusion criteria as well as content and processes. Throughout the search, articles were screened according to inclusion and exclusion criteria, duplicates between databases were eliminated, and a secondary title and abstract review was completed. The articles were then critically appraised and their content collated.

To be included in this systematic review, studies had to meet the following inclusion criteria: (1) inclusion of a diagnosis of ASD or PDD; (2) randomized or nonrandomized controlled clinical trials (Level III evidence or above); (3) published in the English language and in peer-reviewed journals within the past 15 years (year 2000 and after); and (4) inclusion of occupational therapy interventions and services related to feeding and eating. Studies were excluded from the systematic review if they were

qualitative studies, case studies, non-experimental studies, or single-subject designs (below Level III evidence) or were systematic reviews and/or meta-analyses to avoid redundancy in results.

As a primary goal of this project, we aimed to submit an article in alignment with the OT profession's guidelines for systematic reviews to increase the rigor of our study. These guidelines were reviewed prior to constructing the final article and adhered to throughout the writing process (American Occupational Therapy Association [AOTA], 2015; Moher, Liberati, Tetzlaff, & Altman, 2009). We created an evidence table with the results of this systematic review, and included implications of research for OT practice in accordance with these guidelines (AOTA, 2015).

Research Question

The following research question guided the article selection process throughout the course of this study: What higher-level occupational therapy evidence has been found to be consistent and effective for addressing feeding and eating difficulties in children with ASD and PDD?

Chapter III consisted of the process used for gathering information in order to disseminate the final results. Chapter IV provides a summary of key findings and includes the significance of the results in addressing the lack of feeding and eating occupational therapy interventions in the literature.

Chapter IV

Product & Results

Chapter IV consists of a systematic review manuscript that was specifically written for submission to the American Journal of Occupational Therapy (AJOT). Careful consideration was taken for the AJOT and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, used by the AJOT for systematic reviews, to increase the rigor and consistency of our study. These guidelines were reviewed prior to constructing the final article and adhered to throughout the writing process. These guidelines included a 22-page or 4,000-word limit, adherence to the 6th edition of the *Publication Manual of the American Psychological Association* (APA, 2010), and an “Implications of Research for Occupational Therapy Practice” section (AOTA, 2015; Moher et al., 2009).

Our search yielded a total of 7,189 titles and abstracts that were narrowed through the screening process to 27 articles for review. The majority of article non-selection was due to the lack of subjects’ diagnosis of either Autism Spectrum Disorders (ASD) or Pervasive Developmental Disorders (PDD), the article presenting with lower than level III evidence, or the lack of feeding and eating occupational therapy interventions within the studies. The secondary review resulted in 11 articles, which received a full-text review. Two articles were eliminated because one was determined to represent lower than level III evidence and the other was a systematic review. A total of 9 articles were

determined to meet this study's pre-established inclusion criteria and be appropriate for critical appraisal. Their results were compiled in an evidence table that was designed according to PRISMA guidelines and in accordance with the AJOT systematic review requirements and incorporated into the final article for submission. The final manuscript, *Occupational Therapy Feeding and Eating Interventions for Autism Spectrum Disorders and Pervasive Developmental Disorders: A Systematic Review*, can be viewed in its entirety in Appendix A.

Chapter IV provided a brief summary of the systematic review manuscript and the results, which are compiled in an evidence table. Chapter V is comprised of a summary and overview of the project, including limitations, conclusions, and implications for occupational therapy practice.

Chapter V

Summary

Chapter V consists of a discussion of the results, including a summary and limitations of the studies examined in this systematic review. In addition, future recommendations for research, limitations of this systematic review, and implications for occupational therapy practice are discussed.

Discussion and Conclusion

Our review is the first systematic review to specifically analyze occupational therapy feeding and eating interventions for Autism Spectrum Disorders (ASD) and Pervasive Developmental Disorders (PDD) diagnoses. The main foci of the studies examined in this systematic review were to determine what interventions were effective in reducing disruptive mealtime behaviors and increasing dietary variety. Interventions included operant conditioning, systematic desensitization, parent training groups, nonremoval procedures, repeated taste exposure, hierarchical sequencing, and the use of a pager prompt (Anglesea, Hoch, & Taylor, 2008; Gale et al., 2011; Koegel et al., 2012; Levin, Volkert, & Piazza, 2014; Marshall, Hill, Ware, Ziviani, & Dodrill, 2015; Paul, Williams, Riegel, & Gibbons, 2007; Penrod, Gardella, & Fernand, 2012; Seiverling, Williams, Sturney, & Hart, 2012; Sharp, Burrell, & Jacquess, 2014). Previous studies regarding this population have focused on the difficulties with feeding and eating; however, there is a lack of higher-level evidence in the literature (Cermak et al., 2010;

Howe & Wang, 2013; Marshall et al., 2014; Martins et al., 2008; Nadon et al., 2011; Tomchek & Dunn, 2007; Wang et al., 2011). Despite the variety of interventions used to address feeding and eating difficulties in children with ASD and PDD, our review only found studies with evidence for interventions for children with ASD. Only two studies were found to have strong Level I evidence for feeding and eating interventions (Marshall et al., 2015; Sharp et al., 2014).

One study, Marshall et al. (2015), examined the use of operant conditioning and systematic desensitization interventions by use of a prospective parallel group randomized control trial (RCT) with 68 children who had a diagnosis of ASD and a non-medically complex history. They found no statistically significant differences across primary and secondary outcome measures existed; however, large effect sizes were found for reduced difficult mealtimes behaviors and increased dietary variety (Marshall et al., 2015). In another study, Sharp et al. (2014) examined the use of an Autism MEAL Plan by use of a RCT with 19 children who had a diagnosis of ASD. They found clinically significant scores for decreased parental stress upon completion of the Autism MEAL Plan; however, no significant differences were found in regards to mealtime behaviors or dietary variety (Sharp et al., 2014). Despite the rigor in these two studies, neither study produced significant outcomes for feeding and eating behaviors as a results of these interventions.

There were positive responses for dietary variety (Koegel et al., 2012; Marshall et al., 2015; Paul et al., 2007; Sharp et al., 2014), number of foods consumed (Gale et al., 2011; Koegel et al., 2012; Levin et al., 2014; Paul et al., 2007; Penrod et al., 2012; Seiverling et al., 2012), and disruptive mealtime behaviors (Gale et al., 2011; Marshall et

al., 2015; Paul et al., 2007; Seiverling et al., 2012; Sharp et al., 2014) reported in many of the studies examined in this systematic review. For example, Anglesea et al. (2008) found a pager prompt to be an effective tool in slowing meal consumption for three adolescents with ASD. Systematical hierarchical sequencing, as well as operant conditioning and systematic desensitization, were found to increase the number of accepted foods, dietary variety, and spontaneous requests for food without disruptive behaviors in three children with ASD (Koegel et al., 2012; Marshall et al., 2015). Various combinations of re-distribution, swallow facilitation, and chaser treatments were used successfully to decrease packing and increase the variety of foods for two children with ASD (Levin et al., 2014). Paul et al. (2007) and Penrod et al. (2012) found that escape prevention, repeated taste exposure, and fading increased the variety of foods and decreased inappropriate behaviors despite active refusal for children with ASD. Furthermore, Seiverling et al. (2012) used a parent training intervention to successfully increase the number of foods consumed for three boys with ASD. Despite the positive effects of these interventions, either no inferential statistical analyses were completed or statistically significant results were not reported in these studies, highlighting important implications for future research.

This systematic review highlights the various discrepancies regarding research for occupational therapy feeding and eating interventions for children with ASD and PDD. First, all studies examined in this systematic review did not conduct their interventions for the diagnosis of PDD. Only a diagnosis of ASD was examined in regards to feeding and eating interventions. Second, seven (Anglesea et al., 2008; Gale et al., 2011; Koegel et al., 2012; Levin et al., 2014; Paul et al., 2007; Penrod et al., 2012; Seiverling et al.,

2012) of the nine studies used two or three participants in their sample size and all nine studies (Anglesea et al., 2008; Gale et al., 2011; Koegel et al., 2012; Levin et al., 2014; Marshall et al., 2015; Paul et al., 2007; Penrod et al., 2012; Seiverling et al., 2012; Sharp et al., 2014) used non-probability sampling methods, which limited the generalizability of their results to the larger population of children with ASD. Third, a control group was lacking in seven (Anglesea et al., 2008; Gale et al., 2011; Koegel et al., 2012; Levin et al., 2014; Paul et al., 2007; Penrod et al., 2012; Seiverling et al., 2012) of the nine studies, which limited the ability of the researchers to accurately analyze the effectiveness of their interventions. Additionally, interventions were lacking consistency in length and frequency of treatment provided, as well as the setting in which interventions took place. Fourth, Rosenthal and Hawthorne effects potentially skewed the results of all nine studies to be more positive than not. Lastly, only two studies (Marshall et al., 2015; Sharp et al., 2014) utilized standardized outcome measures, which limits the ability of other researchers to replicate these studies. All of these factors ultimately limited the internal and external reliability of these studies and rigor.

One of the most significant implications of this systematic review is that despite the focus on occupational therapy feeding and eating interventions, there were no studies that specifically addressed feeding and eating issues for those with ASD and PDD using interventions that were specifically labeled as occupational therapy interventions by the authors of the published studies. Marshall et al. (2014) conducted a similar systematic review and meta-analysis researching the efficacy of interventions in this population; however, they did not specifically address occupational therapy. While Marshall et al. (2014) reported on similar interventions, limitations, and results, the lack of occupational

therapy interventions brings into question whether or not occupational therapy practitioners have the research findings and resources necessary to provide evidence-based interventions for feeding and eating difficulties in this population. Occupational therapy practitioners are educated on various strategies to address these issues by establishing a developmental sequence of self-feeding skills, improving acceptance of a wide variety of food and textures, addressing sensory difficulties, or improving oral-motor skills through systematic desensitization and operant conditioning programs (Cermak et al., 2010; Howe & Wang, 2013; Marshall et al., 2013), which are all described in the articles presented in this study. However, without the rigorous, high-level evidence specific to occupational therapy practice, occupational therapists are limited in the ability to provide best practice for patients and their families.

Future Directions

Future actions and development of research procedures and protocols are needed to increase the scientific rigor of the studies by eliminating the influence of interfering factors and providing optimal opportunities to examine the effects of specific interventions related to occupational therapy. Recommendations include research studies designed with higher-level evidence at the forefront, including the use of a control group, the ability to manipulate the independent and dependent variables, and randomization to increase external validity and eliminate bias regarding subjects. In addition, standardized measurement tools and larger sample sizes would allow the interventions to be replicated by other researchers and the results to be generalized to the entire populations of persons with ASD and PDD. Therefore, future research efforts of occupational therapists should focus on the development of a protocol to address these feeding and eating issues with

this population. This protocol should then become standardized and used in research studies to examine effectiveness, feasibility, and ability to produce positive outcomes with entire populations, as well as provide evidence for future practitioners in occupational therapy and related fields.

Limitations

In this systematic review, there were potential threats to internal validity due to the inability to accurately answer the research question. The lack of occupational therapy interventions in the literature forced us to rely on our current knowledge of occupational therapy interventions that could be used with this population, which creates the potential threat for researcher bias. In addition, this systematic review is limited by the quality of evidence of the individual studies and their respective designs and methods. Lastly, our role as novice researchers could have influenced the accuracy of the results and the conclusions drawn from the studies.

Implications for Occupational Therapy Practice

The results of this systematic review have the following implications for occupational therapy practice:

- Current evidence is limited in regards to occupational therapy feeding and eating interventions for persons with ASD and PDD.
- Higher-level evidence is needed to support the practice of occupational therapists to address feeding and eating issues for persons with ASD and PDD.
- The development of a specific protocol to use with this population is warranted to standardize occupational therapy treatment for feeding and eating difficulties.

Feeding and eating are important occupations for all children; however, children with ASD and PDD may have lifelong abnormal impairments in social interaction and restricted patterns of behavior, impacting their ability to engage in these occupations successfully (Marshall et al., 2013). As a result, maladaptive and problematic behaviors, such as picky eating, food preferences, gastrointestinal issues, food refusal, and food selectivity may occur (Ahearn et al., 2001; Brown & Dunn, 2010; Wang et al., 2011). These behaviors then carry over into all aspects of daily life, including bathing, eating, dressing, play, and social interaction both in the home environment and in the community. To counteract these behaviors and increase positive outcomes, occupational therapists need to consider locating and implementing not only evidence-based interventions, but also effective evidence-based interventions. Without rigorous research, the occupational therapy profession faces the potential threat of losing our unique value and role in providing feeding and eating interventions for children with ASD and PDD.

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APPENDICES

Appendix A1
Systematic Review Manuscript

Occupational Therapy Feeding and Eating Interventions for Autism Spectrum Disorders
and Pervasive Developmental Disorders: A Systematic Review

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Abstract

This systematic review examines the literature published between January 2000 and December 2015 related to the effectiveness of occupational therapy feeding and eating interventions for persons with Autism Spectrum Disorders (ASD) and Pervasive Developmental Disorders (PDD). Of the 7,189 abstracts and titles resulting from an initial search, 9 articles met inclusion criteria for critical appraisal. Results were inconclusive and no significant outcomes existed for feeding and eating behaviors as a result of occupational therapy interventions. Future recommendations include research studies with higher-level design, standardized measurement tools, and larger sample sizes to increase rigor and provide support for evidence-based practice. In addition, the development of a specific protocol is recommended to standardize occupational therapy treatment for feeding and eating difficulties in persons with ASD and PDD.

Key Terms: *feeding, feeding methods, feeding behaviors, eating, eating behaviors, Autism Spectrum Disorders, autism, autistic disorder, Pervasive Developmental Disorders, occupational therapy, occupational therapy interventions*

Introduction

There is currently limited published evidence regarding feeding and eating interventions for children with Autism Spectrum Disorders (ASD) and Pervasive Developmental Disorders (PDD) (Marshall, Hill, & Dodrill, 2013). Feeding and eating issues have been subjectively reported in this population of children, creating a need for interventions to address these issues (Ahearn, Castine, Nault, & Green, 2001). The lack of evidence available limits the provision of effective, evidence-based intervention delivery for this population by health care providers. It is anticipated the results of this study will further the evidence for consistent and effective occupational therapy feeding and eating interventions for children with ASD and PDD.

The diagnostic criteria for children with ASD, according to the *Fifth Edition of the Diagnostic and Statistical Manual of Mental Disorders* (DSM-5), includes persistent deficits in social communication and social interaction skills, restrictive and repetitive patterns of behavior, and clinically significant problems in other areas of functioning (American Psychiatric Association [APA], 2013). The diagnosis of PDD is included within the definition of ASD as a result of the changes made in the DSM-5 (APA, 2013). Researchers have defined these behaviors as impairments in flexibility and restricted patterns of interest (Koegel et al., 2012); however, each child varies in the severity and type of symptoms displayed, making these behaviors difficult to measure objectively.

Children with ASD and PDD may experience auditory processing, visual processing, tactile processing, attentional, and arousal difficulties. Some researchers have also found sensory processing difficulties in children with ASD and PDD, including

preferences for certain, foods, textures, and tastes (O'Donnell, Deitz, Kartin, Nalty, & Dawson, 2012). These sensory processing issues lead to maladaptive and problematic behaviors that disrupt all activities of daily living and meaningful occupations (Brown & Dunn, 2010). These are relevant topics and areas for intervention for occupational therapists who typically address feeding and eating problems that may be common in children with ASD, PDD, and other developmental disabilities. Despite this, methodological rigor has been lacking in published research on the topic of feeding difficulties and this population of children (Ahearn et al., 2001).

Feeding and Eating Behaviors in Children with ASD and PDD

Feeding and eating difficulties have been well documented in the literature for children with ASD and PDD; however, the exact prevalence of these issues is relatively unknown. Feeding problems are typically defined by an abnormal pattern of oral or enteral consumption of nutrients that lead to negative social or health consequences (Laud, Girolami, Boscoe, & Gulotta, 2009). Children with ASD have been found to have inflexible eating patterns, including consuming a restricted amount of foods (Koegel et al., 2012; Marshall, Ware, Ziviani, Hill, & Dodrill, 2014); preferences for foods high in carbohydrates, sugars, and salt; pica; preferences for specific textures, temperatures, colors, and cravings (Ahearn et al., 2001; Marshall et al., 2014; Nadon, Feldman, Dunn, & Gisel, 2011; Provost, Crowe, Osbourn, McClain, & Skipper, 2010; Wang, Tancredi, & Thomas, 2011). Researchers have also identified abnormal patterns when children were allowed to feed themselves, including food refusal, food type selectivity, and food texture selectivity (Ahearn et al., 2001; Laud et al., 2009; Provost et al., 2010). In addition, children with ASD have presented with feeding difficulties in the

form of extreme food neophobia, food refusal, disruptive mealtime behaviors, coughing/gagging, vomiting, choking, drooling, and a tendency for being overweight (Laud et al., 2009; Marshall et al., 2014; Nadon et al., 2011; Provost et al., 2010). The onset and persistence of these feeding difficulties is influenced by multiple factors and varies between children depending on the causes or maintaining factors from physiological dysfunctions to inappropriate reinforcement of behavior during feeding (Laud et al., 2009). Although the current research has limited use of systematic, objective evaluations to measure the prevalence and nature of feeding patterns and children with ASD (Ahearn et al., 2001), a vast array of information for this topic is available.

Comparison to Typically Developing Children

Overall, researchers have found that children with ASD, PDD, and other developmental disabilities have different feeding and eating patterns than their typically developing peers and present with more disruptive mealtime behaviors (Martins, Young, & Robson, 2008; Provost et al., 2010). Further research is, however, warranted to determine if feeding difficulties are characteristic solely to children with ASD or if abnormal levels of difficulties exist in children with any type of developmental delay (Ahearn et al., 2001). It is unclear whether or not feeding difficulties for children with autism are different from typically developing children due to the large amount of anecdotal evidence from parent report found in the existing literature (Martins et al., 2008). Schrek, Williams, and Smith (2004) conducted one of the first studies comparing children with ASD and typically developing children in regards to eating behaviors. Results confirmed previous research findings that the eating behavior of children with

ASD is restricted by food category and increased food refusal compared to typically developing children (Schrek et al., 2004).

Inconsistent results in the literature have shown that increased picking eating behavior and poor self-feeding skills were only marginally more present in children with autism in comparison to their typically-developing siblings (Martins et al., 2008). Furthermore, children with autism were more likely to avoid foods and exhibit fearful behaviors of new food (Martins et al., 2008). The lack of using a comparison group makes it difficult to distinguish if the high prevalence of selective eating is unique to those children with ASD or if typically developing children have the same prevalence (Cermak, Curtin, & Bandini, 2010). The discrepancies in the research lead to the need for further research in this population, because no widespread explanation exists (Laud et al., 2009).

Influence of Symptoms on Daily Life

ASD may have a lifelong impact on activities of daily living due to abnormal or impaired developments in social interaction and restricted patterns of behavior (Marshall et al., 2013). More specifically, these children may be having increased difficulty in school, especially during lunch and/or snack times, and also with their peers. Sensory aversions, such as oral defensiveness and tactile defensiveness, may negatively influence eating (Cermak et al., 2010), and further alienate these children from their typically developing peers. These feeding and eating behaviors affect all other areas of functioning not only for the children themselves, but also for the family members trying to address these concerns (Provost et al., 2010). In order for these needs to be addressed, occupational therapists need to be aware of the parental concerns, difficulties, and day-to-

day struggles experienced with these children during mealtimes (Nadon et al., 2011; Provost et al., 2010). Cermak et al. (2010) found that increased stress resulted from sensory-based feeding issues, which negatively impacted family mealtimes and overall quality of life.

The Role of Occupational Therapy

Occupational therapists are a vital team member in providing feeding and eating interventions for children with ASD and PDD. The role of occupational therapy is to provide opportunities for children to participate in their everyday occupations, or meaningful daily activities needed to function (American Occupational Therapy Association [AOTA], 2014). The occupational therapy process begins with an evaluation of the child and the creation of short- and long-term goals in order to plan and provide individualized interventions to target specific outcomes determined by the occupational therapist, the family, and the child (AOTA, 2014; O'Donnell et al., 2012). Occupational therapy practitioners address these feeding difficulties in children by establishing a developmental sequence of self-feeding skills, improving acceptance of a wide variety of food and textures, addressing sensory difficulties, or improving oral-motor skills (Cermak et al., 2010; Howe & Wang, 2013). In the current literature, systematic desensitization and operant conditioning programs were the most common approaches used to address feeding difficulties in children with ASD (Marshall et al., 2013); however, research has been inconsistent in regards to the overall effectiveness of the intervention approaches.

Due to the resistant and rigid patterns of thinking and behavior in children with ASD and PDD, occupational therapists are only part of a team involved in the care of these children. An interdisciplinary approach is recommended to address atypical eating

patterns in these children using approaches by various professionals to alleviate the wide range of issues (Cermak et al., 2010), including occupational therapists, dieticians, speech-language pathologists, behavioral psychologists, and family members.

Specifically, occupational therapists bring in behavioral interventions, parent-directed and educational interventions, and physiological interventions (Howe & Wang, 2013).

Study Purpose

The limited evidence and relatively unknown prevalence of feeding and eating issues in children with ASD and PDD forces clinicians who treat children with these diagnoses to rely on the limited amount of information to treat their patients (Marshall et al., 2013). No evidence-based practice guidelines currently exist for addressing feeding difficulties in children with ASD, which impedes the efficacy with which health care providers prescribe interventions. Furthermore, no consistent practices across facilities exist for addressing these concerns (Marshall et al., 2013). The occupational therapy literature would benefit from an increased number of studies with rigorous designs in specific populations to examine the effectiveness of specific techniques for addressing feeding difficulties (Cermak et al., 2010; Howe & Wang, 2013; Marshall et al., 2014; Martins et al., 2008; Nadon et al., 2011; Tomchek & Dunn, 2007; Wang et al., 2011).

Marshall et al. (2014) exemplified how few systematic reviews have been conducted on interventions for children with ASD and feeding difficulties and how the quality of research reviewed has been weak. Marshall et al. (2014) specifically examined the effectiveness of feeding and eating interventions for this population; however, they did not examine the role of occupational therapy in these interventions although occupational therapists are consulted on a daily basis for feeding difficulty intervention in

this population. Therefore, there is a need for research specific to the occupational therapy profession in order to justify the care being provided to these patients and their families rather than other professions. In addition, more research on ASD and feeding difficulties will result in more focused and effective interventions for practitioners, as well as provide evidence-based practice for the occupational therapy profession as a whole (AOTA, 2014; Cermak et al., 2010).

The purpose of this systematic review is to examine the current evidence to determine appropriate and effective occupational therapy interventions to address feeding and eating problems for clients with ASD and PDD. Specifically, we sought to answer: What higher-level occupational therapy evidence has been found to be consistent and effective for reducing feeding and eating difficulties in children with ASD and PDD?

Methods

Research Design and Procedures

We systematically reviewed research literature published in the past 15 years for higher-level evidence to determine which occupational therapy feeding and eating interventions have been found to be consistent and effective for persons with ASD and PDD. The search strategy included a title and abstract review of PubMed, OT Search, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and the American Journal of Occupational Therapy (AJOT) for items published between January 2000 and December 2015. The following Medical Subject Headings (MeSH), subject terms, and keywords were identified and used exclusively during our search: *feeding, feeding methods, feeding behaviors, eating, eating behaviors, Autism Spectrum Disorders, autism, autistic disorder, Pervasive Developmental Disorders, occupational therapy,*

occupational therapy interventions, and occupational therapist. Throughout the search, articles were screened according to inclusion and exclusion criteria, duplicates between databases were eliminated, and a secondary title and abstract review was completed. The articles were then critically appraised and their content collated. Our graduate research advisor also consulted on article inclusion and exclusion criteria as well as content and processes.

Inclusion criteria was: (1) subjects' diagnosis of ASD or PDD; (2) randomized or nonrandomized controlled clinical trials (Level III evidence or above); (3) published in the English language and in peer-reviewed journals within the past 15 years (year 2000 and after); and (4) presence of occupational therapy interventions and services related to feeding and eating. Studies were excluded from the systematic review if they were qualitative studies, case studies, non-experimental studies, or single-subject designs (below Level III evidence) or were systematic reviews and/or meta-analyses to avoid redundancy in results.

Results

Our search yielded a total of 7,189 titles and abstracts that were narrowed through the screening process to 27 articles for review. Articles were removed due to the lack of a diagnosis of either ASD or PDD, lower than level III evidence, or no feeding and eating occupational therapy interventions. The secondary review resulted in 11 articles, which received a full-text review. Two articles were eliminated because one was lower than level III evidence and the other was a systematic review. A total of 9 articles were found to meet inclusion criteria and be appropriate for critical appraisal. Their results were compiled in Table 1.

Discussion and Conclusion

Our review is the first systematic review to specifically analyze occupational therapy feeding and eating interventions for ASD and PDD diagnoses. The main foci of the studies examined in this systematic review were to determine what interventions were effective in reducing disruptive mealtime behaviors and increasing dietary variety. Interventions included operant conditioning, systematic desensitization, parent training groups, nonremoval procedures, repeated taste exposure, hierarchical sequencing, and the use of a pager prompt (Anglesea, Hoch, & Taylor, 2008; Gale et al., 2011; Koegel et al., 2012; Levin, Volkert, & Piazza, 2014; Marshall, Hill, Ware, Ziviani, & Dodrill, 2015; Paul, Williams, Riegel, & Gibbons, 2007; Penrod, Gardella, & Fernand, 2012; Seiverling, Williams, Sturney, & Hart, 2012; Sharp, Burrell, & Jacquess, 2014). Previous studies regarding this population have focused on the difficulties with feeding and eating; however, there is a lack of higher-level evidence in the literature (Cermak et al., 2010; Howe & Wang, 2013; Marshall et al., 2014; Martins et al., 2008; Nadon et al., 2011; Tomchek & Dunn, 2007; Wang et al., 2011), which was also evident in this systematic review. Despite the variety of interventions used to address feeding and eating difficulties in children with ASD and PDD, our review only found studies with evidence for interventions for children with ASD. Furthermore, only two studies were found to have strong Level I evidence for feeding and eating interventions (Marshall et al., 2015; Sharp et al., 2014).

One study, Marshall et al. (2015), examined the use of operant conditioning and systematic desensitization interventions by use of a prospective parallel group randomized control trial (RCT) with 68 children who had a diagnosis of ASD and a non-medically complex history. They found no statistically significant differences across primary and secondary outcome measures existed; however, large effect sizes were found for reduced difficult mealtimes behaviors and increased dietary variety (Marshall et al., 2015). In another study, Sharp et al. (2014) examined the use of an Autism MEAL Plan by use of a RCT with 19 children who had a diagnosis of ASD. They found clinically significant scores for decreased parental stress upon completion of the Autism MEAL Plan; however, no significant differences were found in regards to mealtime behaviors or dietary variety (Sharp et al., 2014). Despite the rigor in these two studies, neither study produced significant outcomes for feeding and eating behaviors as a results of these interventions.

There were positive responses for dietary variety (Koegel et al., 2012; Marshall et al., 2015; Paul et al., 2007; Sharp et al., 2014), number of foods consumed (Gale et al., 2011; Koegel et al., 2012; Levin et al., 2014; Paul et al., 2007; Penrod et al., 2012; Seiverling et al., 2012), and disruptive mealtime behaviors (Gale et al., 2011; Marshall et al., 2015; Paul et al., 2007; Seiverling et al., 2012; Sharp et al., 2014) reported in many of the studies examined in this systematic review. For example, Anglesea et al. (2008) found a pager prompt to be an effective tool in slowing meal consumption for three adolescents with ASD. Systematical hierarchical sequencing, as well as operant conditioning and systematic desensitization, were found to increase the number of accepted foods, dietary variety, and spontaneous requests for food without disruptive behaviors in three children

with ASD (Koegel et al., 2012; Marshall et al., 2015). Various combinations of re-distribution, swallow facilitation, and chaser treatments were used successfully to decrease packing and increase the variety of foods for two children with ASD (Levin et al., 2014). Paul et al. (2007) and Penrod et al. (2012) found that escape prevention, repeated taste exposure, and fading increased the variety of foods and decreased inappropriate behaviors despite active refusal for children with ASD. Furthermore, Seiverling et al. (2012) used a parent training intervention to successfully increase the number of foods consumed for three boys with ASD. Despite the positive effects of these interventions, either no inferential statistical analyses were completed or statistically significant results were not reported in these studies, highlighting important implications for future research.

This systematic review highlights the various discrepancies regarding research for occupational therapy feeding and eating interventions for children with ASD and PDD. First, all studies examined in this systematic review did not conduct their interventions for the diagnosis of PDD. Only a diagnosis of ASD was examined in regards to feeding and eating interventions. Second, seven (Anglesea et al., 2008; Gale et al., 2011; Koegel et al., 2012; Levin et al., 2014; Paul et al., 2007; Penrod et al., 2012; Seiverling et al., 2012) of the nine studies used two or three participants in their sample size and all nine studies (Anglesea et al., 2008; Gale et al., 2011; Koegel et al., 2012; Levin et al., 2014; Marshall et al., 2015; Paul et al., 2007; Penrod et al., 2012; Seiverling et al., 2012; Sharp et al., 2014) used non-probability sampling methods, which limited the generalizability of their results to the larger population of children with ASD. Third, a control group was lacking in seven (Anglesea et al., 2008; Gale et al., 2011; Koegel et al., 2012; Levin et

al., 2014; Paul et al., 2007; Penrod et al., 2012; Seiverling et al., 2012) of the nine studies, which limited the ability of the researchers to accurately analyze the effectiveness of their interventions. Additionally, interventions were lacking consistency in length and frequency of treatment provided, as well as the setting in which interventions took place. Fourth, Rosenthal and Hawthorne effects potentially skewed the results of all nine studies to be more positive than not. Lastly, only two studies (Marshall et al., 2015; Sharp et al., 2014) utilized standardized outcome measures, which limits the ability of other researchers to replicate these studies. All of these factors ultimately limited the internal and external reliability of these studies and rigor.

One of the most significant implications of this systematic review is that despite the focus on occupational therapy feeding and eating interventions, there were no studies that specifically addressed feeding and eating issues for those with ASD and PDD using interventions that were specifically labeled as occupational therapy interventions by the authors of the published studies. Marshall et al. (2014) conducted a similar systematic review and meta-analysis researching the efficacy of interventions in this population; however, they did not specifically address occupational therapy. While Marshall et al. (2014) reported on similar interventions, limitations, and results, the lack of occupational therapy interventions brings into question whether or not occupational therapy practitioners have the research findings and resources necessary to provide evidence-based interventions for feeding and eating difficulties with this population. Occupational therapy practitioners are educated on various strategies to address these issues by establishing a developmental sequence of self-feeding skills, improving acceptance of a wide variety of food and textures, addressing sensory difficulties, or improving oral-

motor skills through systematic desensitization and operant conditioning programs (Cermak et al., 2010; Howe & Wang, 2013; Marshall et al., 2013), which are all described in the articles presented in this study. However, without the rigorous, high-level evidence specific to occupational therapy practice, occupational therapists are limited in the ability to provide best practice for patients and their families.

Future Directions

Future actions and development of research procedures and protocols are needed to increase the scientific rigor of the studies by eliminating the influence of interfering factors and providing optimal opportunities to examine the effects of specific interventions related to occupational therapy. Recommendations include research studies designed with higher-level evidence at the forefront, including the use of a control group, the ability to manipulate the independent and dependent variables, and randomization to increase external validity and eliminate bias regarding subjects. In addition, standardized measurement tools and larger sample sizes would allow the interventions to be replicated by other researchers and the results to be generalized to the entire populations of persons with ASD and PDD. Therefore, future research efforts of occupational therapists should focus on the development of a protocol to address these feeding and eating issues with this population. This protocol should then become standardized and used in research studies to examine effectiveness, feasibility, and ability to produce positive outcomes with entire populations, as well as provide evidence for future practitioners in occupational therapy and related fields.

Limitations

In this systematic review, there were potential threats to internal validity due to the inability to accurately answer the research question. The lack of occupational therapy interventions in the literature forced us to rely on our current knowledge of occupational therapy interventions that could be used with this population, which creates the potential threat for researcher bias. In addition, this systematic review is limited by the quality of evidence of the individual studies and their respective designs and methods. Lastly, our role as novice researchers could have influenced the accuracy of the results and the conclusions drawn from the studies.

Implications for Occupational Therapy Practice

The results of this systematic review have the following implications for occupational therapy practice:

- Current evidence is limited in regards to occupational therapy feeding and eating interventions for persons with ASD and PDD.
- Higher-level evidence is needed to support the practice of occupational therapists to address feeding and eating issues for persons with ASD and PDD.
- The development of a specific protocol to use with this population is warranted to standardize occupational therapy treatment for feeding and eating difficulties.

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Appendix A2
Table 1. Effectiveness of OT Feeding and Eating Interventions

| Author, Year | Level of Evidence/Study Design/Participants/Inclusion Criteria | Intervention and Control Groups | Outcome Measures/Limitations | Results |
|---------------------------------|--|--|---|--|
| Anglesea, Hoch, & Taylor (2008) | Level III Reversal Design <i>N</i> = 3 teenage boys with Autism who demonstrated independent eating skills and had a history of consuming food rapidly. Purposive Sampling | Based on availability in the subjects' classrooms, two types of vibrating pagers were used (the MotivAider or the Invisible Clock) at specific time intervals to cue subjects to take a bite of food. Initially, physical and verbal prompts were used with an inactivated pager to train the subjects how to use the devices after which the subjects used the devices during lunch in the school cafeteria. | <i>Outcome Measures:</i> A digital timer was used to record the total number of seconds to consume food, and pencil and paper were used to record total number of bites. <i>Limitations:</i> <ul style="list-style-type: none"> • Rosenthal effect • Hawthorne effect • Only measure of time • No control group • Limited generalizability • Small sample size & sampling bias | The total amount of time to consume food increased for all three subjects. This indicated that a pager prompt was an effective intervention to use for teenagers with Autism to slow meal consumption. |
| Gale, Eikeseth, & Rudrud (2011) | Level III Non-concurrent Multiple Baseline Design <i>N</i> = 3 children, ages 46-52 months, with a diagnosis of Autism who were pre-school aged and receiving home-based Early Intensive Behaviors Intervention 40 hours per week. Purposive sampling | This study consisted of two phases: (1) functional assessment with interview and video-taped observation based on current eating environment and habits, and (2) focused interventions for each child from interviews and video-taped observations made during phase 1. Phase 2 included an intervention with positive reinforcement to increase acceptance, and non-contingent | <i>Outcome Measures:</i> The Functional Assessment Interview (FAI) and the Functional Assessment Direct Observation (FAO) to gather more information about acceptance and refusal behaviors in each child. Follow-up with the FAI was completed with 2 participants at 4 and 5 months. | Inconclusive results due to uncontrolled variables for each participant, including age and length of time demonstrating feeding difficulties. |

| Author, Year | Level of Evidence/Study Design/Participants/Inclusion Criteria | Intervention and Control Groups | Outcome Measures/Limitations | Results |
|----------------------|--|--|---|---|
| Koegel et al. (2012) | Level III Clinical Replication and Multiple Baseline Designs N = 3 children with a diagnosis of ASD between 6 and 7 years of age and inflexible mealtime behaviors Purposive sampling | negative reinforcement for refusal and disruptive behavior. Interventions were conducted in the child's home by the parents and ABA tutors as therapists. Each of the three subjects were randomly assigned a baseline number of sessions to target foods that were presented to the child in daily sessions that included 20 trials and lasted for 10 minutes. | <p><i>Limitations:</i></p> <ul style="list-style-type: none"> • Rosenthal effect • Hawthorne effect • Limited or not reported psychometric properties of instruments • Sampling method limited external validity • Varying number of sessions • Small sample size & sampling bias <p><i>Outcome Measures:</i></p> <p>No standardized measures listed although interobserver agreement was high for each subject. One tester was blinded to independent variable conditions.</p> <p>Variables measured included number of foods accepted, spontaneous requests for new foods, comments recorded on video, and level of acceptance for each food.</p> <p>Outcome measures were completed before and after treatment and at follow-up.</p> | No inferential statistical analysis or results were reported in this study but descriptive statistics were presented. By the end of intervention, all three children accepted food without any disruptive behaviors. Number of accepted foods and spontaneous requests for food increased in all three children from baseline to follow-up. |

| Author, Year | Level of Evidence/Study Design/Participants/ Inclusion Criteria | Intervention and Control Groups | Outcome Measures/Limitations | Results |
|---------------------------------|---|--|--|---|
| Levin, Volkert, & Piazza (2014) | Level III Repeated Measures Design N = 2 children with a diagnoses of ASD, 4 years of age and admitted to an outpatient or day-treatment feeding disorders program. Purposive sampling | Treatment for both children occurred in a feeding disorders clinic in the Midwestern United States. Feeders conducted one meal per week for 1 hour with Nick. Feeders conducted 2-5 meals per day for 30 to 45 min per meal for Cara with at least 1 hour between the start of each meal. Each meal consisted of multiple five-bite sessions with brief breaks between sessions conducted in therapy rooms with one-way observation and sound. Different combinations of re-distribution, swallow facilitation, and chaser treatments were used to decrease packing. | <p><i>Limitations:</i></p> <ul style="list-style-type: none"> • Rosenthal effect • Hawthorne effect • Limited generalizability • Small sample size & sampling bias <p><i>Outcome Measures:</i></p> <p>No standardized measures were listed though interobserver agreement was high for each subject.</p> <p>Packing was measured with mouth clean checks at 15 and 30 second intervals</p> <p>Acceptance of food was measured by number of foods eaten</p> <p>Outcome measures for packing were collected throughout the course of treatment.</p> <p><i>Limitations:</i></p> <ul style="list-style-type: none"> • Rosenthal effect • Hawthorne effect • Unestablished outcome measures • Small sample size & sampling bias | <p>No inferential statistical analysis or results were reported in this study but descriptive statistics were presented.</p> <p>Nick improved from being 90 percent dependent on a feeding tube and only consuming small bites of table food to consuming age-appropriate amounts of various table foods in 21-minute spans.</p> <p>Cara improved from receiving 50 percent of her dietary consumption through vanilla rice milk and pear juice and a limited variety of Stages 2 and 3 baby foods to eating small pieces of 4 different foods.</p> |

| Author, Year | Level of Evidence/Study Design/Participants/ Inclusion Criteria | Intervention and Control Groups | Outcome Measures/Limitations | Results |
|---|--|--|--|--|
| Marshall, Hill, Ware, Ziviani, & Dodrill (2015) | <p>Level I</p> <p>Prospective parallel-group RCT</p> <p>$N = 68$ Children with ASD and NMC history between the ages of 2 and 6 years with a diagnosed feeding difficulty characterized by “either food selectivity by type (<10 foods across each food group: fruits/vegetables, proteins, carbohydrates) (21) or food selectivity by texture (eg, only consuming purees) (21). Participants may also have presented with mealtimes averaging >30 minutes (22), and/or clinically significant difficult mealtime behaviors (1) that were having an impact on parental stress” (p. 681).</p> <p>OC intervention group $n = 36$</p> <p>SysD intervention group $n = 32$</p> <p>Convenience sampling</p> | <p><i>OC/SysD Interventions</i></p> <p>Between 7 and 10 sessions 30-60 min in length which included 30 foods; Parents had the option of intervention being provided in a weekly (10 sessions for 10 weeks) or intensive (10 sessions in 1 week) manner and were involved in a parent training program focused on feeding skills, behavior, and nutrition at the same time the child engaged in the intervention.</p> <p><i>OC Intervention</i></p> <p>“Top-down” prompt-and-reward therapy; other strategies included shaping; High-intensity exposure: 3 foods per session and different foods each session</p> <p><i>SysD Intervention</i></p> <p>“Bottom-up” modeling and play-based therapy; other strategies included linking foods by sensory and motor attributes; Repeated low-level exposure: 10 foods per session and the same foods for sessions 1–4, 5–7, 8–10</p> | <p><i>Outcome Measures:</i></p> <p>3-day weighed food diary with dietary analysis completed by an independent rater</p> <p>Mealtime behaviors: Behavioral Pediatrics Feeding Assessment Scale (BPFAS)</p> <p>Primary outcome measures were collected at baseline, post intervention, and 3-month follow-up and multiple baseline measures were completed by parents.</p> <p><i>Limitations:</i></p> <ul style="list-style-type: none"> Rosenthal effect Hawthorne effect Psychometric properties of instruments not reported Convenience sampling bias | <p>There were no statistically significant differences across primary and secondary outcome measures; however, there were statistically significant differences for demographic and baseline characteristics for all subjects.</p> <p>Large effect sizes were found for difficult mealtimes behaviors (Total frequency score-child, $P = 0.15$) and increased dietary variety (Total food count, $P = 0.06$); however, differences were not statistically significant.</p> |
| Paul, Williams, Riegel, & | <p>Level III</p> <p>Repeated-Measures Design</p> | <p>The goal of treatment was to increase the variety of foods through multiple taste sessions and probe meals using</p> | <p><i>Outcome Measures:</i></p> <p>No standardized measures listed.</p> | <p>No inferential statistical analysis or results were reported in this study but</p> |

| Author, Year | Level of Evidence/Study Design/Participants/Inclusion Criteria | Intervention and Control Groups | Outcome Measures/Limitations | Results |
|------------------------------------|--|---|--|---|
| Gibbons (2007) | N = 2 children (ages 3 ½ & 5 years), each with a diagnosis of ASD and referred for food selectivity or food refusal Sampling procedures not reported | escape prevention, repeated taste exposure, and fading. Each session lasted approximately 10 minutes and all sessions were completed between 13 and 15 days. Therapists conducted all taste sessions during week one and progressed to parents completing sessions independently. | Number of foods consumed was measured by length of time until bite consumption or number of full teaspoons consumed during a probe meal. Inappropriate behaviors were measured by the percentage of food expulsion or negative vocalizations for each trial. Outcome measures were completed before and after treatment and at a 3-month follow-up. <i>Limitations:</i> <ul style="list-style-type: none"> • Rosenthal effect • Hawthorne effect • Limited generalizability • Small sample size | descriptive statistics were presented. There was an increase in variety of foods and a decrease in inappropriate behaviors for both children in the lab and at home. |
| Penrod, Gardella, & Fernand (2012) | Level III Repeated-Measures Design N = 2 boys, ages 9 and 10 years, with a diagnosis of ASD and a history of food selectivity. Both boys had to have a limited food repertoire and be resistant to trying new foods. | All treatment sessions took place in a research lab on the CSUS Campus. There were 2-4 consecutive sessions with 5 minute breaks during 2-3 days a week. Sessions were trial based rather than time based, and approximately 10 minutes in duration. | <i>Outcome Measures:</i> A single-stimulus preference assessment was used during pretreatment and posttreatment by two observers to measure percentage of bites consumed and percentage of compliance with low- <i>p</i> instructions. Follow-up assessments in the subjects' homes were completed | Both boys increased their consumption as a result of the feeding intervention despite active refusal. Both boys were able to generalize learning and maintained increased food consumption in their home environments. |

| Author, Year | Level of Evidence/Study Design/Participants/Inclusion Criteria | Intervention and Control Groups | Outcome Measures/Limitations | Results |
|---|--|--|---|--|
| Seiverling, Williams, Sturme, & Hart (2012) | Level III Multiple Baseline Design N = 3 boys between 4 and 8 years old with a diagnosis of ASD and food selectivity and their mothers Purposive sampling | Intervention included a prebaseline assessment of foods eaten by the family, baseline taste sessions, parent-fed baseline probe meals, parent training, posttraining, and follow-up. Parents were instructed by the experimenter and received feedback during trials prior to completing the first taste session with the boys. Parent training was considered complete when 90% of steps were performed correctly. | at 3, 6, and 12 weeks after treatment with the parent and the experimenter present. <i>Limitations:</i> <ul style="list-style-type: none"> • Rosenthal effect • Hawthorne effect • Realism due to lab • Limited generalizability • Limited sample size <i>Outcomes Measures:</i> No standardized measures listed though interobserver agreement was between 92 and 99 percent for all subjects. Parent behavior measured by correct number of steps performed during taste sessions and probe meals. Child behavior measured by acceptance of food and disruptive behavior. Outcomes measures were recorded before and after treatment and follow-up occurred at 3 or 4 weeks. <i>Limitations:</i> | No inferential statistical analysis reported. Parent performance improved based on the mean percentage of correct steps performed during taste sessions and probe meals. Per parent report, all three children increased the number of foods eaten following intervention. |

| Author, Year | Level of Evidence/Study Design/Participants/ Inclusion Criteria | Intervention and Control Groups | Outcome Measures/Limitations | Results |
|-----------------|---|---------------------------------|---|---------|
| | | | <ul style="list-style-type: none"> • Rosenthal effect • Hawthorne effect • Limited generalizability • Small sample size • Internal validity compromised by interactive effects • Lack of standardized instrumentation | |

| Author, Year | Level of Evidence/Study Design/Participants/Inclusion Criteria | Intervention and Control Groups | Outcome Measures/Limitations | Results |
|----------------------------------|---|--|--|---|
| Sharp, Burrell, & Jaquess (2014) | <p>Level I</p> <p>RCT</p> <p>$N = 19$ children between the ages of 3 and 8 years with an ASD diagnosis and who had a total SRS score in the mild, moderate, or severe range. The presence of a significant feeding issue was not a requirement of the study.</p> <p>Intervention $n = 10$</p> <p>Control $n = 9$</p> <p>Purposive sampling</p> | <p><i>Intervention</i></p> <p>Autism MEAL Plan: general behavior management strategies, specific interventions for feeding problems associated with ASD, and strategies for promoting self-feeding. The program includes a standardized manual created by the authors of this study and not included in the article.</p> <p><i>Control</i></p> <p>Completed the assessment battery during preintervention, received e-mail correspondence with handouts on nonfeeding-related topics with limited behavioral content, were offered the educational curriculum following completion by the treatment group, and completed a final evaluation.</p> | <p><i>Outcome Measures:</i></p> <p>Brief Autism Mealtime Behavior Inventory (BAMBI) to measure mealtime behavior problems observed. Strong reliability and validity reported.</p> <p>Food Preference Inventory (FPI) to measure dietary preference for consumption. No psychometric properties reported.</p> <p>Parenting Stress Index - short form (PSI-SF) to measure level of parenting stress. High internal validity reported.</p> <p>Outcome measures were collected at baseline and post intervention.</p> <p><i>Limitations:</i></p> <ul style="list-style-type: none"> • Rosenthal effect • Hawthorne effect • Limited generalizability • Small sample size and sampling bias | <p>The total score and 3 subscale scores of the BAMBI indicated there were no statistically significant changes in feeding behaviors.</p> <p>The FPI indicated no significant differences in dietary preferences after completion of the Autism MEAL Plan.</p> <p>Clinically significant scores were found for PSI-SF in the treatment group, indicating low parental stress after completing the Autism MEAL Plan.</p> |

Notes: ASD = Autism spectrum disorders; RCT = randomized control trial; NMC = non-medically complex history; ABA = Applied behavioral analysis; OC = operant conditioning; Sysd = systematic desensitization; SRS = Social Responsiveness Scale