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Chapter 1

Occupational Therapy's Role in the Treatment of Children with Autism Spectrum Disorders

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Additional information is available at the end of the chapter

http://dx.doi.org/10.5772/intechopen.78696

Abstract

Occupational therapists (OT) offer a wide range of therapies for individuals with ASD on the basis of specific deficits and difficulties. This chapter explores the role that OT plays, and the expertise, in relation to the interdisciplinary team. In addition, it discusses and presents empirical support for several therapeutic approaches commonly used by OTs working with individuals with ASD.

Keywords: occupational therapy, ASD, treatment

1. Learning objectives

After completing this chapter, readers will be able to:

1. Understand and explain the role of occupational therapy in the treatment of autism spectrum disorders.
2. Understand the application occupational therapy interventions to individuals with autism spectrum disorders.
3. Identify and describe a variety of popular therapeutic approaches utilized in occupational therapy for individuals with autism spectrum disorders.
4. Analyze popular therapeutic approaches for treating autism spectrum disorders using an evidence-based practice lens.

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2. Occupational therapy

2.1. Introduction

Occupational therapists are part of the rehabilitation team for persons with injury, illness, and/or disability. The primary goal of OT is to promote functional independence.

2.2. Occupational therapy

Occupational therapy has been described as the art and science of helping people do the day-to-day activities that are important and meaningful to their health and well-being through engagement in valued occupations [1]. Occupational therapy draws on the centrality of occupations to daily life. It is concerned with helping clients engage in all the activities that occupy their time, enable them to construct identity through doing, and provide meaning throughout their lives [2]. As a part of the therapy provided, the client, group or population is expected to engage in meaningful occupation(s). Occupational engagement is the capacity to contribute to one's own health and well-being [3].

Ultimately, OT professionals (occupational therapists and occupational therapy assistants) help people of all ages participate in the things they want and need to do through the therapeutic use of everyday activities (occupations). Unlike other professions, occupational therapy helps people function in all of their environments (e.g., home, work, school, community, virtual) and addresses the physical, psychological, and cognitive aspects of their well-being through engagement in occupation(s) [1].

2.3. Occupation

In exploring occupational therapy (OT) and its role in the treatment of individuals with an ASD, time must be spent defining the term occupation. Historically, the term *occupation* was defined as the way in which people use or occupy their time [4]. Yerxa, one of the founders of occupational science, more recently defined occupation as the "specific chunks of activity within an ongoing stream of behavior which are named in the lexicon of the culture…. These daily pursuits are self-initiated, goal directed (purposeful) and socially sanctioned" ([5], p. 5). Other occupational therapy scholars have described occupation as everything people do to occupy themselves, including looking after themselves (self-care), enjoying life (leisure) and contributing to the social and economic fabric of their communities (productivity) [6].

Occupations occur throughout the lifespan, in context, and are influenced by the interplay among client factors (capacities characteristics and beliefs of the person), performance skills (goal directed actions), and performance patterns (habits, routines, and roles). Occupations occur over time; have purpose, meaning, and perceived utility to the individual; and can be observed by others (e.g. writing one's name) or known only to the person involved (e.g. morning grooming routine). Occupations can involve the execution of multiple activities for completion and result in various outcomes. The broad range of occupations are categorized by the American Occupational Therapy Association (AOTA) into activities of daily living

(ADLs), rest and sleep, education, work, play, leisure, and social participation [1]. To understand how these occupational categories are used in therapy, it is important to review the occupational therapy philosophy.

2.4. Occupational therapy philosophy

Hooper and Wood best articulated the philosophical underpinnings of OT, stating that "ever changing humans, interconnected with ever changing environments, occupy time with ever changing occupations, and thereby transform–and are transformed by–their actions, environment and states of health" ([7], p. 38). This philosophy supports the domain, process, and intervention of therapy practice.

2.4.1. Domain

The domain of occupational therapy practice is heavily influenced by AOTA's Occupational Therapy Practice Framework [1] and the World Health Organization's International Classification of Functioning [8]. The domain of occupational therapy includes the areas of occupation: activities of daily living, instrumental activities of daily living, rest and sleep, education, work, play, leisure, and social participation. The domain also encompasses aspects of functioning that impact occupational performance. According to AOTA, these aspects include performance skills (motor skills, process skills, and social interaction skills), performance patterns (habits, routines, rituals, and roles) and context/environment (cultural, personal, physical, social, temporal, and virtual) [1].

2.4.2. Process

The occupational therapy process involves the actions and reasoning of practitioners which are used to provide services that focus on the client's participation and performance in daily occupations. The occupational therapy process is designed to be holistic in nature capturing the client as the individual, his or her family, and other supports, while at the same time taking into consideration the individual's interaction with the physical, social and attitudinal contexts of function [1]. The process may be direct 1:1, group, and/or consultative in delivery, with the aim to create opportunities for optimal health, well-being, and lifelong engagement in occupations [1].

The evaluation aspect of the process includes gathering, interpreting and synthesizing information that is relevant to the client's past and current engagement and performance in meaningful occupations (ADLs, IADLs, play, etc.), in addition to his or her desired goals and priorities for the short and long term future [1]. Furthermore, the evaluating therapist assesses the barriers and supports that impact the client's health, well-being, and participation.

2.4.3. Intervention

The intervention process consists of skilled services provided by occupational therapy practitioners (OTs and occupational therapy assistants) in collaboration with clients to facilitate

engagement in occupations related to health, well-being, and participation [1]. The intervention process includes a plan, implementation, and review [9]. The aim of the intervention is to improve the client's desired and expected participation and performance in occupations through the implementation of techniques and procedures that are directed towards the client or towards his or her environment and/or activities [1]. A unique aspect of the intervention process is the standard procedure of practitioners using the collective influence of the client's context and environment, demands of the activity at hand, and the individual characteristics of the client [1]. This procedure is formally characterized as a task analysis [9].

In order to practice occupational therapy, practitioners must first gain an understanding of the domain, process, and intervention utilized in OT while completing their higher education at a school that is accredited by the Accreditation Council for Occupational Therapy Education (ACOTE).

2.5. Education

The current degree required for entry-level occupational therapists is a master's degree. The Occupational Therapy Doctorate (OTD) is also available as an entry level-degree, but is not currently required by ACOTE. Obtaining graduate degree assures that practitioners have the knowledge and skills necessary to fully implement evaluation and intervention to remediate functional deficits.

In addition to occupational therapists, OT personnel are also comprised of occupational therapy assistants (OTAs). OTAs must minimally obtain an associate's degree from an ACOTE accredited institution. OTAs must work under the supervision of an occupational therapist and are generally tasked with implementing intervention and performing other tasks in support of the OT plan of care, which vary depending on the state in which the OTA practices.

After completing their formal education, both occupational therapists and OTAs are required to pass a national registration exam offered by the National Board for Certification in Occupational Therapy. OTs and OTAs who pass the registration exam are then eligible to apply for state licensure and to assume a practice role.

2.6. Occupational therapy roles

Occupational therapists can assume a variety of roles in clinical practice. These roles include, but are not limited to: clinician, manager, case coordinator, policy maker, educator, and advocate. Roles cross a variety of practice settings, such as acute care, subacute care, outpatient care, home care, early intervention, and school-based practice. In a survey study completed by the AOTA, approximately 24% of OT practitioners provide services in school and early intervention based settings while many additional therapists work in freestanding community-based clinics and hospital-based settings that include pediatric services [11, 12].

2.7. Occupational therapy and the treatment of autism spectrum disorders

In the evaluation and treatment of individuals with ASD, OT professionals tend to address ADLs, IADLs, adaptive behavior, rest and sleep, employment/pre-employment, and social

participation. Underlying these issues, therapists seek to improve performance with gross motor, fine motor, and visual-motor integration skills; visual perception; sensory processing; and behavioral regulation [1]. Additionally, the evaluation and treatment process of individuals with ASD includes context (conditions within and surrounding the client) and the environment (external physical and social conditions), activity demands (tools, space, action and performance skills needed) and finally client factors (underlying beliefs, abilities and values) [1]. The OT professional takes into account the setting where the services will be provided and the environments where the individual functions and/or plans to function [1]. Caregivers play a significant role in occupational therapy treatment and are recognized as the 'client' while evaluating the child with ASD. Factors such as socio-demographic characteristics, roles, habits, rituals and the occupational balance of caregivers are to be taken into consideration [10, 11].

The specific intervention techniques used in OT with individuals with ASD include; establishing new functional skills, modifying activity demands, creating healthy lifestyles, maintaining existing performance, and preventing future difficulties for clients at risk [12]. One of the hallmark features of individuals with ASD is their tendency towards strong preferences and focused interest. While this tendency may be considered maladaptive for the generation of new skills, the OT may use it to influence the client's self-esteem and motivation to take part in areas of occupation as well as the intervention process through judicious choice of treatment activities that tap into an individual's preferences and interest [1].

3. Treatment approaches for autism spectrum disorders utilized by occupational therapists

With the increase in awareness and identification of children on the autism spectrum, teachers, researchers, clinicians, and families have worked diligently to create programming that can meet the varied and unique needs of this population. Often these approaches are developed for use across all aspects of a child's life, and as such, are intertwined in all services provided. While some approaches are utilized primarily in occupational and physical therapy (e.g. Ayres Sensory Integration), others are used across all disciplines (e.g. Applied Behavior Analysis). Whatever approach is selected, it is important to remember to communicate with the interprofessional team in order to determine best practices with each individual child and that the interventions provide purposeful activity [13, 14]. Occupational therapy professionals place significant value on the individual with autism's community participation and that it can be increased through their participation in meaningful and purposeful activities [15, 16]. The following sections review some of the more commonly used approaches in therapy.

3.1. Sensory processing treatment approaches

Difficulty processing sensory information has been identified as a common feature of ASD. The current best estimates demonstrate that up to 96% of children with ASD demonstrate difficulty with processing sensory information as a part of their daily routines [13, 15, 17]. Restricted, Repetitive Patterns of Behavior, Interest, of Activities" and that one of those 4

has something to do with "sensory features" [18]. The inability to accurately process sensory information impacts all areas of child development, so approaches directed towards remediation of sensory processing deficits are often used by both occupational therapists.

3.2. Ayres sensory integration intervention

3.2.1. Purpose of the technique

Ayers Sensory Integration Intervention® (ASII) is a clinical procedure grounded in sensory integration theory [19]. The intervention focuses on aiding clients to register, process, integrate and adequately respond to internal and external sensations that occur within the clients' daily life, contexts, and relationships. Sensory integration has been defined as "the neurological process that organizes sensations from one's own body and from the environment and makes it possible to use the body effectively in the environment" ([20], p. 11). ASII is aimed at remediating integration disruptions and increasing participation and performance among individuals who experience sensory disturbances or a sensory processing disorder. An internet survey identifying treatments used for children with ASD indicated that Sensory Integration (a broadly used term) was the third most commonly requested intervention requested by caregivers [21].

3.2.2. Overview of the technique

Intervention guided by sensory integration theory [19] has been reported to be commonly used by therapists who work with children with various types of developmental delays and medical and behavioral conditions [22, 23]. ASII includes the following steps within the standardized intervention protocol:

1. ensure physical safety of the client,

2. present active sensory opportunities (tactile, proprioceptive & vestibular),

3. help the client attain and maintain appropriate levels of alertness,

4. challenge postural, ocular, oral and/or bilateral motor control,

5. challenge praxis and organization of behavior,

6. collaborate between the client and the therapist on activity choice,

7. tailor the activities to present a just right challenge for the client,

8. ensure that activities are successful,

9. support the child's intrinsic motivation to play, and

10. establish therapeutic alliance between the client and the therapist [24, 25].

3.2.3. Review of the evidence

Pfeiffer, Koenig, and associates conducted a randomized-control trial with 37 children diagnosed with ASD who were between the ages of 5–12 years of age [26]. Seventeen participants

were assigned to a control group focused on fine motor intervention and 20 participants were assigned to the experimental group who received ASII. The study reported no significant differences in the subjective perception of sensory processing difficulties via the Sensory Processing Measure and objective ratings on the Quick Neurological Screening Test, 2nd Edition, between the control and experimental groups. Yet the authors reported a significant difference between groups in the reduction of autistic mannerisms and social responsiveness as measured by the Social Responsiveness Scale. Both groups demonstrated statistically significant improvement with Goal Attainment Scaling (focused on sensory processing, motor skills, & social functioning). However, there was a higher effect size in the ASII group than in the fine motor group.

Another randomized-control trial evaluated the efficacy of ASII among 32 children aged 4–8 years old, diagnosed with ASD [27]. In this trial, the experimental group using ASII ($n = 17$) scored significantly higher at posttest in the areas of self-help skills and socialization, than did the control group ($n = 15$) who received standard care. Additionally, the authors reported that children in the ASII group were better able to reach specific goals than the control group when measured using Goal Attainment Scaling. Children in the ASII group also experienced greater decreases in sensory related behaviors than the control group.

Iwanaga et al. utilized a quasi-experimental design to explore the use of ASII on 20 preschool aged children with high functioning autism [28]. It was reported that the children in the experimental group, who received ASII, demonstrated significantly higher total post test scores on the Miller Assessment of Preschoolers when compared to the control group. Significant improvements were noted specifically in the areas of motor coordination, nonverbal cognitive abilities, and sensory motor abilities following ASII treatment.

Case-Smith et al. conducted a systematic review on sensory integration with standardized administration protocols that occurred in clinics that used sensory-rich, child directed activities to improve a child's adaptive responses to sensory experiences [15]. They found and reviewed two randomized controlled trials, which reported positive effects for ASII on the participants (children with ASD) using Goal Attainment Scaling (with reported effect sizes ranging from .72 to 1.62); the additional studies analyzed included Level III–IV research studies, that reported positive effects on reducing challenging behaviors linked to sensory processing difficulties.

Kashefimehr et al. reported improvement in a sensory integration intervention group ($n = 16$) over a control group ($n = 15$) among children with ASD. The authors reported that the participants in the intervention group demonstrated significant improvements in the subjective measures of the Short Child Occupational Profile and the Sensory Profile. Of significant note the authors reported improvements not only in sensory processing domains (tactile processing, vestibular processing, etc.) but also in occupational performance based upon the Model of Human Occupation [29, 30].

It is important to make a clear distinction between ASII and other sensory-based interventions, as ASII has strict implementation protocol that may not always be followed accurately. In a review of more than 70 published research articles examining the efficacy of ASII, it was found that only three adhered to the theory and intervention protocols [25, 29, 30]. The reason for this disparity is that research conducted (in occupational and speech therapy, special education and psychology) generally did not report if the researchers designed the

intervention to represent Ayres' original therapeutic principles. Furthermore, it was not noted if the researchers monitored intervention delivery during the studies to ensure that a high degree of fidelity to the ASII was maintained [30–32]. This is an important notation when evaluating the efficacy of ASII, as the majority of the research claiming to be examining the effects of sensory integration treatment may really be evaluating sensory-based and sensory-motor-based interventions.

3.3. Sound-based interventions

3.3.1. Purpose of the technique

Sound-based interventions (SBIs) are a type of sensory-based intervention used by occupational therapists and some physical therapists with children diagnosed with ASD. SBIs originated from the work of Tomatis [33, 34], whose research on the ear and its connection to the nervous system led to his theory that one's "listening function" affects voice, language, motivation, coordination and learning abilities [35]. The theory that Tomatis postulated was that by listening to certain frequencies, the brain could retrain itself by creating new neural pathways, thereby compensating for dysfunctional brain structures or pathways. Tomatis's ideas led to the development of several SBIs, including the Tomatis Method®, Auditory Integration Training®, Therapeutic Listening®, Integrated Listening Systems® and The Listening Program®.

3.3.2. Overview of the technique

SBIs involve listening to psychoacoustically modified music, yet the manufacture of each SBI differs in the dosage, type of music used, how it is combined with other intervention techniques. In most cases therapists (occupational and some physical therapists) use SBIs as combined modality with other sensory-based treatment or to augment Ayres Sensory Integration Intervention.

3.3.3. Review of the evidence

Because the evidence supporting the use of SBIs with children with ASD is mixed, these techniques are non-reimbursable and should be considered experimental. To date, most research on SBIs has been focused on the Tomatis Method and Auditory Integration Training and has produced mixed empirical results [36, 37]. Some studies have suggested that these interventions may be effective for individuals with ASD, citing improvements in areas such as language, psychomotor skills, personal and social adjustment, non-verbal communication and adaptation to change [38, 39]. However, other research has found little to no significant improvement in individuals who received SBIs as compared to the control groups [40, 41]. Recent single case research indicated that some children with ASD using home-based SBIs demonstrated mild to moderate improvements in behavioral and sensory tolerance [42]. Other case studies observed a reduction in behaviors and scores related to auditory sensory over responsivity, as well as a reduced number and duration of self-stimulatory behaviors after using a SBI in conjunction with occupational therapy [43, 44].

3.4. Weighted blankets

3.4.1. Purpose of the technique

Sleep and rest disturbances are important self-care challenges that are commonly faced by many children with ASD, with 44–83% of individuals reporting some form of sleep disturbances [45]. Humphreys and associates found that children between the ages of 18 months and 11 years with ASD slept 17–43 min less each night than their typically developing matched peers, with decreased sleep patterns found to be most pronounced in children between the ages of 30 and 42 months [46]. Additionally, Malow and associates found that children with ASD who slept poorly showed an average decrease in rapid eye movement sleep, possibly providing a partial explanation for their finding that disordered sleep in children with ASD exacerbates behavioral problems during the day [47].

As sleep is important for overall wellbeing, occupational therapists may work with individuals to establish healthy sleep routines in their clients, commonly including children with ASD and their families. They often assist such children in obtaining adequate sleep by experimenting with different sleep routines, using cognitive and behavioral interventions, and/or implementing sensory-based interventions [48]. Weighted blankets are an example of a sensory-based intervention commonly used in helping children with autism spectrum disorders attain adequate sleep participation. The underlying theory behind their use is that weighted blankets provide deep pressure touch without movement restrictions. This deep pressure, in turn, releases endorphins and serotonin to relax and calm the individual and help the individual to modulate sensory input [49, 50]. These relaxing sensations, it is hypothesized, allow the individual to be better able to fall asleep and stay asleep.

3.4.2. Overview of the technique

Typically, weighted blankets are applied to children during sleep-time activities (nighttime and naps). The weight of the blankets used anecdotally is 10% of the child's body weight. The blankets size is large enough to cover the child's body, not including face and/feet. The intention is that the blanket will remain on top of the child throughout the duration of sleep.

3.4.3. Review of the evidence

The evidence to support the efficacy of using weighted blankets is scarce. Creasey and Finlay were unable to find any relevant primary or secondary evidence exploring the effectiveness of weighted blankets' impact on sleep in children with ASD [51]. Despite this lack of evidence, there is parental/caregiver anecdotal support of use, and as such, many advocate for the use of weighted blankets. One study published after Creasey and Finlay's review studied 73 children, aged 5–16 years, all of whom had an autism spectrum disorder diagnosis and reported sleep disturbances [52]. Using a crossover design, study participants were given a weighed blanket to sleep with for 2 weeks, followed by a period during which they slept with a non-weighted blanket that was provided by the researchers. The core findings were that weighted blankets were no more effective than a typical blanket in helping children with ASD improve

their total sleep time or other qualitative and quantitative sleep measures. Parents of the children in the study, however, reported an improvement in next-day behaviors, a finding that the authors hypothesized might have been due to improved bedtime behaviors, improved parent/child interactions, or inflated reports by parents wishing to please the study team.

Gee and associates conducted a study to explore the efficacy of weighted blankets with children with an ASD and sleep disturbances using a single case, multiple baseline design [44]. This study focused on two children with an ASD and sensory over-responsivity. The authors found that there were minimal changes reported via caregivers after 14 nights of use, yet they indicated improvement in the areas of time to fall asleep, number of wakings in the night, duration of sleep and behavior in the morning. Gee and associates, utilizing a similar demographic, sample size, and measures, reported that children with ASD and sensory over-responsivity demonstrated a correlation between their morning mood and the number of hours slept the previous night [53]. Furthermore, it was reported that morning mood of the participants improved during the intervention phase of the ABA design.

Overall, the evidence supporting the use of weighted blankets continues to be weak, as such, this technique is considered experimental and should be used with caution.

3.5. Weighted vests

3.5.1. Purpose of the technique

Weighted vests have been used for individuals with ASD presumably to influence their somatosensory systems [54]. Specifically, weighted vests are often used to provide deep pressure for individuals who demonstrate sensory over-responsiveness, and resistance to those with sensory under-responsiveness/seeking behaviors. However, the use of weighted vests has become popular with children with ASD in hopes of increasing attention, on-task behaviors, and social engagement [55], while decreasing stereotypical behaviors [56].

3.5.2. Overview of the technique

A weighted vest is a type of sensory-based intervention. A weighted vest is a garment that typically has 1–4 lbs. (approximately 10% of the child's total body weight) of total weight evenly distributed across it [56]. These vests are primarily applied to preschool and elementary school-aged children with the diagnoses of ASD or attention deficit disorder [56]. The weighted vest is worn according to a pre-determined schedule at certain times of the day, including during everyday activities and for specified tasks at home, in the classroom, or in the community. The vest is typically applied for less than 1 h, one to two times per day during tabletop type tasks [56]. These are general intervention recommendations, but not a manualized approach. Lacking a standardized protocol for the weighted vest, most occupational therapists rely on clinical reasoning in devising an appropriate wearing schedule [57].

3.5.3. Review of the evidence

According to reviews, studies regarding the use of weighted vests are limited in size, scope, and quality. In a meta-analysis study of single subject designs, Stephenson and Carter

reported that using weighted vests among young children was on the ineffective side, partially due to small sample sizes and poor methodology within the literature [58]. In another meta-synthesis by Losinski and associates, the research studies included were found to be of low quality, with the effects of deep pressure via weighted vests for individuals with disabilities (including ASD) were small among the variables of attention, disruptive behavior, self-injury, and stereotypy [59].

Small scale studies offer mixed results of the use of weighted vests. McGinnis and associates, reported that young children with ASD actual enjoy using weighted vests, and the application of these vests may serve as positive reinforcement, rather than bringing about changes in sensory processing [60]. Another study using an AB single subject design, found that weighted vests did not decrease problem behaviors (distraction, emotional reaction, withdrawal, escape/avoid, etc.) nor facilitate joint attention with primary caregivers among four toddlers with ASD and sensory processing difficulties [55].

The evidence in support of using weighted vests to address challenging behaviors rooted in sensory processing is almost absent, with additional research exploring the intervention with more typical behaviors among individuals with ASD. As such, AOTA does not include the use of weighted vests as a therapeutic technique in its publications. This is exemplified in two recent seminal works that therapists rely upon to guide practice: *Autism: A Comprehensive Occupational Therapy Approach* [61] and *Occupational Therapy Practice Guidelines for Individuals with Autism Spectrum Disorder* [62]. Due to the lack of evidence, weighted vests should be used with caution. Any use of weighted vests should be aligned with strong diagnostics related to sensory processing behaviors, deficits, and outcomes.

3.6. Task-oriented treatment approaches

Task-oriented treatment approaches assist children with ASD to develop the skills necessary to complete a particular task. Children with ASD often have difficulty completing tasks due to a variety of difficulties in communication, socialization, motor skills, and sensory processing. Task-oriented approaches consider the task to be completed and ways in which to accomplish the goal. Task-oriented approaches are utilized by both occupational and physical therapists to teach functional skills.

3.7. Treatment and Education of Autistic and Related Communication-Handicapped Children (TEACCH)

3.7.1. Purpose of the technique

The Treatment and Education of Autistic and Communication-Handicapped Children (TEACCH) program is intended to assist children in completing daily tasks by providing instructions that are clear and understandable in an environment that is highly structured and supportive [63]. TEACCH is considered a structured teaching program that recognizes the characteristics commonly associated with autism spectrum disorder, specifically communication problems, preference for visual information, sensory-related difficulties, attention variability, intense interests/impulses, and time management issues [64]. By offering a highly structured teaching environment focused on each child's individual ASD characteristics and

the task at hand, learning development can occur. TEACCH is considered to be a multi-disciplinary approach, focused on collaboration between a variety of service providers, including teachers, therapists, family, and community [65].

3.7.2. Overview of the technique

The TEACCH program was developed in 1972 by Eric Schopler, Ph.D. at the University of North Carolina at Chapel Hill [66]. The program focuses on utilizing structure in a manner that encourages learning. According to Mesibov and Shea, structure in TEACCH comprises four components: physical structure, timing structure, task structure, and work/activity system structure [66]. Physical structure requires that the environment be set up in order to focus learning. This includes offering visual cues in the environment. Timing structure incorporates the use of a schedule, including scheduling cues. Organizing the task into manageable chunks is part of the task structure, this includes offering explicit directions. Finally, work/activity system structure involves synthesizing smaller tasks into a complete activity. By controlling these four structural elements, care providers can create an environment that maximizes functional capabilities of the child with ASD.

Along with utilizing TEACCH in a school or clinic setting, it is recommended that a home TEACCH program be developed for carry-over by parents/caregivers [67]. Ideally, the home TEACCH program would provide training and clinician supervision to parents/caregivers to assist them in structuring the home environment in order to support teaching skills in self-care, academics, and communication [67].

3.7.3. Review of literature

As TEACCH was developed and has training facilities housed within the University of North Carolina at Chapel Hill, there are researchers embedded in the program who have worked to establish a strong research base. When analyzing efficacy, it is important to identify potential bias that might occur by reviewing studies conducted only by researchers working where the technique was developed. To avoid that bias, a number of studies from within and outside the University of North Carolina at Chapel Hill were reviewed.

A meta-analysis of intervention studies using TEACCH (level 1 evidence) was conducted by Virues-Ortega, Julio, and Pastor-Barriuso in 2013 [68]. This meta-analysis utilized 13 studies, with a combined sample of 172 children diagnosed with ASD, assessing perceptual and motor skills, adaptive behaviors, and language and cognition. Results indicated that TEACCH had a small magnitude impact on perceptual, motor, verbal and cognitive skills, a negligible impact on communication, activities of daily living, and motor functioning, and moderate to large gains in social behavior and maladaptive behavior. The overall effect of the TEACCH program on all the outcomes measured in the meta-analysis was moderate, with effects in older children being higher than those in younger children. The authors cautioned that while these findings indicate success with TEACCH, the small number of studies and sample size should be considered.

D'Elia and associates conducted a longitudinal study of low-intensity TEACCH in preschool aged children [65]. The study followed a sample of 30 children, aged 2–6.11 years,

diagnosed with autistic disorder or pervasive developmental disorder – not otherwise specified over a 2 year period. The group was split evenly into a control group that did not receive TEACCH and an experimental group that received the TEACCH intervention 2 h per week at school and 2 h per week at home. Results for the main outcome indicators of severity of autism, language, and adaptive functioning showed no significant difference between the control group and the experimental group. Results for the secondary outcomes of parental stress and psychopathological comorbidity indicated significant differences between the control group and the experimental group. Both secondary outcomes indicated greater improvement in the experimental group. The authors indicate that the lack of significance in primary outcomes could possibly be attributed to the low intensity of the TEACCH intervention, which is not standard protocol. The positive secondary outcomes indicate potential of the TEACCH program in decreasing parental stress and child behavioral/emotional problems.

With home-based TEACCH being a major component of the program, it is important to determine the efficacy of that particular approach. Weterlin and associates conducted a study on the efficacy of the Home-TEACCHing Program (HTP) on toddlers with ASD [67]. The sample included twenty 2–3 year old children and their parents. Children and their parents were randomly assigned to either the treatment (HTP) group or the waitlist (WL) group. WL group members were informed that they would receive the treatment at the conclusion of a 12 week wait period. This study yielded three major findings: (1) HTP improved children's independent work skills; (2) Parents were able to structure the physical environment to improve child outcomes; (3) Parents improved their effective prompting, including using visual prompts. Although the sample size was small, findings demonstrate support for the use of the Home-TEACCHing Program.

Overall, research to date on effectiveness of the TEACCH program is very encouraging. Therapists use the components of TEACCH to assist children with ASD in learning tasks. Specifically, therapists using this technique will structure the physical environment (including visual cues), and organize the task with explicit directions in order to assist the child in learning new skills that aid in improved functional outcomes.

3.8. Cognitive orientation to occupational performance (CO-OP)

3.8.1. Purpose of the technique

The Cognitive Orientation to Occupational Performance (CO-OP) is a task-oriented, problem-solving approach that uses cognitive skills to improve occupational performance. It is typically a verbally based approach that emphasizes teaching clients to incorporate self-talk and problem-solving to address difficulty with the execution of various motor skills [69]. According to Missiuna and associates, elements of CO-OP include concepts related to problem-solving, learning theory, motor learning theory, cognitive strategies, client-centered practice, goal setting, and motivation [69]. CO-OP has been observed to be highly individualized, starting with clinician generated verbal guidance, followed by the development of client internal self-dialog, and finally independent application of problem-solving strategies ([70], p. 190).

Missuana and associates identified that the three main objectives addressed by CO-OP are: (1) skill acquisition in client-chosen goals/tasks, (2) cognitive strategy development, and (3) generalization of subsequently learned skills and strategies to a variety of contexts. Specifically, in the CO-OP process the client is learning a new motor skill or improving performance on one that has not yet developed sufficiently to be functional [69].

In CO-OP, a client-centered approach is used to encourage clients to select their own goals for the intervention plan. The CO-OP cognitive strategies are used to influence skill acquisition. Generalization and transfer of skills is supported through the use of an executive, or problem-solving, strategy that trains the child to monitor his performance and self-evaluate the outcome [69].

Rodger et al. have argued that in order for clients with ASD to be successful in taking part in CO-OP, therapists need to ensure they have accommodated the language and communication needs of the clients, given that the technique relies heavily on language and communication [71]. The goal of CO-OP is to create a process to teach clients how to think, instead of what to think.

3.8.2. Overview of the technique

According to Polatajko and Mandich, during CO-OP, clients are instructed on a global cognitive strategy and are then guided in the process of discovering other cognitive strategies that are relevant to their chosen goals. The global strategy used in CO-OP is "the goal, plan, do, check" [70]. Specifically, this foundational strategy involves working with the client to identify "what needs to be done, planning how to achieve this, carrying out the plan and then evaluating its effectiveness" ([72], p. 184).

Domain specific strategies (DSS) are specific cognitive strategies that are task, child or situation specific and focus on facilitating or improving performance [69]. The child is guided to develop his/her own strategies based on the problems encountered during tasks [72].

3.8.3. Review of the evidence

CO-OP has been evaluated across diverse populations (pediatric and adult) and conditions (ASD, cerebral palsy, developmental coordination disorder, cerebral vascular accident, traumatic brain injury) [73–76]. The current research of CO-OP among children and adolescents diagnosed with high functioning and/or mild ASD have emerged using case studies/series approaches.

Several case studies (Level IV-V) have been conducted among diverse segments of the spectrum of children/adolescents with autism. Phelan and associates reported general improvement on the Canadian Occupational Performance Measure and the Performance Quality Rating Scale among two children with ASD [77]. Visual analysis indicated consistent increase in performance on both subjective scales and across the three client-centered goals across a 10 session plan of care.

In another case study of two participants with ASD, Rodger and Brandenburg found that after 10 weekly sessions using CO-OP, the participants demonstrated improvements on the

pre and post-intervention assessment [78]. Specifically, moderate to significant improvement was noted on the caregiver subjective scale using the Canadian Occupational Performance Measure, Performance Quality Rating Scales and the Vineland Adaptive Behavior Scales.

Overall, the CO-OP approach for children and adolescents with ASD has yielded positive findings, enhancing function and participation in meaningful activities as a part of activities of daily living and instrumental activities of daily living and supports its use in clinical practice, yet more research needs to be conducted using more robust designs.

3.9. Behavioral treatment approaches

Behavioral treatment approaches to ASD incorporate components of operant conditioning in order to manipulate behavior to create positive outcomes. When considering ASD, the primary behavioral treatment approach used is Applied Behavior Analysis (ABA), which is applied in a variety of forms (school-based, clinic-based, home-based, discrete trial training, Lovaas therapy, inclusive programs). Generally, occupational and physical therapists will follow an ABA approach if the child is currently enrolled in a program that specifically uses ABA, or if the child is learning a discrete skill that would benefit from an ABA approach (e.g. toileting, shoe-tying).

3.10. Applied behavior analysis (ABA)

3.10.1. Purpose of the technique

The purpose of Applied Behavior Analysis (ABA) is to teach discrete skills by modifying the environment in order to manipulate behavior [79]. To teach these skills, therapists utilize the "ABC technique" to determine why a behavior is occurring: *antecedent*, *behavior*, *consequence* [63]. Antecedent refers to what is happening prior to the behavior. The *antecedent* prompts the behavior to occur. The *behavior* is what the child does in response to a stimulus (antecedent). Finally, the *consequence* is what the child receives as a response to the behavior. The consequence can perpetuate or extinguish the behavior. Once therapists have determined the "ABC," then they can create a structured plan that addresses each component to create an optimal outcome.

3.10.2. Overview of the technique

Based on principles developed by B.F. Skinner in the 1950s, Clinical Psychologist O. Ivar Lovaas created ABA as a behavior modification program for use in children with ASD [63]. The program is intended for use across a variety of instructional formats, including both group and individual sessions, which allows for independent and observational learning [80].

In ABA programming, once a functional behavior assessment has determined the ABC (antecedent, behavior, consequence), the therapist will determine the target behavior and how the environment will be modified to achieve that behavior. Additionally, the therapist will determine what reinforcement to use and the reinforcement schedule. Reinforcement is a critical component of ABA, and determining appropriate reinforcers is crucial for program success. Often people are tempted to use edible reinforcers (candy, chips). This practice is

highly discouraged, as it can lead to unhealthy eating habits and an inability to develop other motivating reinforcers [80].

Therapists using ABA must be cognizant of their surroundings and the influence of all types of reinforcement, applying a variety of positive reinforcement to keep the child focused and on track. Knowledge of what may reinforce poor behavior is as important as knowing what impacts pro-social behavior. For example, if a child seeks attention and receives it every time he or she acts out, then the attention serves to positively reinforce the acting out behavior. Therapists need to be aware of this and modify reinforcement accordingly.

Once the reinforcement is determined, ABA can begin. A commonly used form of ABA is called Discrete Trial Training (DTT). DTT identifies a specific task, then teaches the task by breaking it into its component parts and repeatedly presenting it to the child until mastery is achieved [63]. This is a repetitive process that often involves multiple presentations over days or weeks. Reinforcement occurs each time the child correctly responds, or in the case of a developing skill, when the response approximates the skill.

3.10.3. Review of literature

The seminal research for the use of ABA for children with ASD was conducted by Lovaas in 1987. This study specifically investigated DTT on a group of 4 year olds over the course of 2–3 years. Lovaas found that 47% of the children in the ABA demonstrated functional improvements, compared to only 2% in the control group. This study has been replicated numerous times across the years, with similar results, indicating that DTT improves IQ, communication, and socialization in children under 4 years old with ASD [63].

A systematic review of behavioral and developmental interventions for children with ASD was conducted by Ospina and associates [81]. In regard to ABA, this review specifically examined 31 studies with a total sample of 770 subjects. Findings related to DTT were inconsistent, with motor and functional outcomes trending positively, while speech outcomes trended negatively. High intensity Lovaas therapy was found to be superior to low intensity programming, and treatment was consistently found to be better than standard care.

Virues-Ortega conducted a meta-analysis of ABA and autism in 2010 [82]. The review analyzed results from 22 studies that included a total of 323 subjects in intervention groups that ranged in age from 22.6 to 66.3 months old. Results indicated positive effects in IQ (18 studies), receptive language (11 studies), expressive language (10 studies), and adaptive behaviors (communication, daily living skills, and socialization, 11 studies). The author did note that analysis was difficult due to the varying methodology used, but indicated overall that ABA intervention is associated with medium to large positive effects in IQ, language, and adaptive behavior.

Overall, research has demonstrated that ABA can be an effective therapeutic technique to teach children with ASD specific skills. Therapists utilize this technique in a variety of formats in order to help improve functional outcomes.

3.11. Social-emotional treatment approaches

Social-emotional treatment approaches are gaining in popularity with children with ASD as research reveals the impact of social/emotional development on all other functional areas.

Embodied cognition is created only when an individual can actively engage in his or her environment [83], which requires social interaction with objects and others. To encourage these interactions and relationships, the Developmental, Individual Difference, Relationship-Based Model (DIR®/Floortime™) was created. This treatment approach is used by both occupational and physical therapists to encourage participation in therapy for children with ASD.

3.12. Developmental, individual difference, relationship-based model (DIR®/Floortime™)

3.12.1. Purpose of the technique

DIR®/Floortime™ is a framework for assessment and intervention that focuses on building social, emotional, and intellectual abilities [84]. This framework seeks to assist children in creating an emotional foundation on which other skills can be encouraged to grow and develop. An important concept of this framework is that is does not seek to teach individual skills in isolation, but rather focuses on the child with ASD as a unique being that is capable of growth by establishing relationships and circles of communication within the environment [84].

3.12.2. Overview of the technique

According to Greenspan and Wieder [84], the DIR® Model was created by Dr. Stanley Greenspan in the 1980s. The model highlights the developmental, individual differences, and relationship-based components of emotional development in children. The developmental part of the model focuses specifically on the six identified developmental levels that are required for emotional health. These hierarchical levels include: (1) self-regulation and interest in the world, (2) engaging and relating, (3) purposeful two-way communication, (4) complex communication and problem-solving, (5) using symbols and creating emotional ideas, and (6) logical thinking and building bridges between ideas.

Individual differences in the DIR® Model refer to the child-specific ways that information can be taken in and processed [84]. It is commonly understood that children with ASD are unique; with each child demonstrating individualized ways of responding to sensory input. These individual differences need to be considered when attempting to factiliate in social–emotional development.

The relationship-based component of the DIR® model refers to the use of emotional connection to foster development. Clinicians utilizing a DIR® approach need to purposefully tailor their actions and communication to engage the child in an emotional relationship [84].

Clinical application of the DIR® model occurs in what is called Floortime™. Therapists engaging in Floortime™ techniques demonstrate skills in getting to the child's level and allowing the child's actions and communications to lead the emotional relationship [84]. By engaging in the child's world, this technique postulates that you can then bring the child into a "shared world" [85]. These techniques, when employed correctly, can help the child with ASD progress through the levels of emotional development.

3.12.3. Review of literature

Research regarding DIR®/Floortime™ appears to be somewhat limited in both scope and vigor, although the research base is expanding. A pilot randomized controlled trial was

completed in 2011 by Pajareya and Nopmaneejumruslers in Thailand [86]. This study utilized 32 participants that were 2–6 years old and were diagnosed with autistic disorder according to the DSM-IV. Participants were randomly assigned to the typical treatment group, or the DIR®/Floortime™—supplemented treatment group. Findings from the study revealed that DIR®/Floortime™ helped children with autism to better engage with caregivers. Additionally, the study found that engagement in DIR/Floortime™ helped parents to better play with their children with autism.

Liao and associates completed a study involving the use of DIR®/Floortime™ at home on preschool-aged children [87]. The study had a sample of 11 young boys and their mothers. Results of the study indicated that the use of DIR®/Floortime™ significantly improved two-way communication, relationship formation, problem solving, and behavioral organization, and adaptive skills. Additionally, mothers who utilized the intervention felt that their parent–child interactions improved.

A randomized controlled trial regarding ASD and DIR®/Floortime™ was conducted by Lal and Chhabria in 2013 [88]. This study utilized a sample of 26 children aged 3–6 who were diagnosed with ASD. These children were randomly assigned to treatment and control groups, with 13 participants in each group. The treatment group received 20 sessions of DIR®/Floortime™ that lasted 30 min each, while the control group received typical early intervention services. Results of this study indicated that all children who received DIR®/Floortime™ demonstrated improved social behavior from pre-test to post-test. Comparison between the control group and treatment group from pre to post-test indicated significant differences, with the DIR®/Floortime™ group showing greater improvement.

These positive results suggest that DIR®/Floortime™ does help in promoting social–emotional growth, which can improve functional outcomes. While the evidence is positive, scope is limited, which suggests caution in application until further studies regarding efficacy can be completed.

4. Conclusion

Occupational therapy is a rehabilitation specialty that facilitates the development of functional skills in children with ASD. Occupational therapists often work as part of an interdisciplinary treatment team. In this capacity, it is important for therapists to communicate across disciplines to be sure that treatment is carried over from one area to another.

There are many therapeutic approaches that occupational therapists can use to encourage growth and development in children with ASD. These treatment approaches have varying levels of evidence supporting their efficacy. Clinicians need to be mindful of the current evidence and use their knowledge of the child and the treatment, along with their clinical judgment, to create effective interventions.

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