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Quantifying Therapists' Activities during Sensory Integration Treatment for Young Children with Autism

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ABSTRACT

Aims: There is limited research on the type and quantity of actions (activities) occupational therapy practitioners utilize when providing sensory integration treatment to children with Autism Spectrum Disorders (ASD).

Methods: A coding scheme identifying specific aspects of sensory integration treatment was developed and used to analyze 34 videos of 9 children with ASD, aged between 18 and 56 months, treated by 8 occupational therapists. Occupational therapists providing sensory integration treatment to children with ASD were behaviorally coded and rated using Observer XT, a software package designed for analysis of behavioral processes.

Results: Verbal communications, including offers, positive commands, and feedback, to facilitate engagement were the most frequent actions enacted by therapists. Proprioceptive activities were the most frequent sensory opportunities presented. Therapists received high ratings for sensitivity qualities.

Conclusions: The number of sensory opportunities and interactions the therapists provided suggest concordance with sensory integration treatment components in the clinical setting. General impression ratings indicate engagement between child and therapist may be an important aspect of sensory integration treatment for young children with ASD. Quantification of therapists' actions can provide insight into the moment-to-moment decision-making and relationships between therapist and child during daily practice of sensory integration treatment.

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There has been a call for documenting facets of daily clinical practice in research, as approaching research from more than one perspective is needed to improve the quality of client care (Crooke & Olswang, 2015; Horn et al., 2012; Stevens et al., 2018). Research within the everyday context of practice can complement traditionally generated research. Practice-based research is grounded in, informed by, and intended to improve practice (Westfall et al., 2007), and can assist in closing the gap between research and practice by uniquely and systematically investigating questions in everyday settings that can generate generalizable knowledge to a discipline's practice (Crooke &

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Olswang, 2015). Thus, practice-based research is an important component needed to understand and improve treatment occurring at clinical practice sites.

Video recordings of treatment sessions from clinical practice settings provide an opportunity to systematically record and quantify two important needs in existing practice: tracking the clinical choices made during the process of the intervention and the measurement of intervention outcomes in daily practice. This study focuses on identifying and quantifying the actions of occupational therapists delivering sensory integration treatment to young children with Autism Spectrum Disorders (ASD) in clinical practice settings. As the number of children with a diagnosis of ASD seeking intervention services increases, it is especially important and timely to document information about daily practice with children with ASD in order to inform future effectiveness research for sensory integration treatment (Baio et al., 2018; Green et al., 2006).

A report from the Center for Disease Control indicates that one in 59 children are affected by Autism Spectrum Disorders (Baio et al., 2018). Sensory processing difficulties are frequently reported in this population and this has resulted in extensive investigation of multiple sensory domains (for review see Baum et al., 2015). Relationships between sensory processing deficits and repetitive behaviors have been demonstrated, suggesting that core features of the disorder could be driven by sensory atypicalities (Wigham et al., 2015). This is further supported by the addition of impairments in sensory processing, such as hypo- or hyper-responsiveness to stimuli, as diagnostic criteria of ASD under Restricted Repetitive Behaviors in the Diagnostic and Statistical Manual 5th Edition (DSM-V) (American Psychiatric Association, 2013).

Sensory integration treatment is frequently requested by parents of children with ASD and is widely employed by occupational therapists with clients with ASD (Green et al., 2006). Recent evidence provides support for a sensory integration treatment as an effective and evidence-based intervention for improving sensory-related difficulties in children with ASD (Pfeiffer et al., 2011; Schaaf et al., 2014; Steinbrenner et al., 2020; Watling & Hauer, 2015; Weitlauf et al., 2017). Additionally, it has been reported that sensory integration treatment resulted in a trend for increased positive affect and elicited communication and eye contact with shared affect with the therapist during vestibular activities. This suggests vestibular activities during sensory integration treatment may change specific behaviors in children with ASD (Thompson & Blanche, 2015).

Incomplete descriptions in the early literature of intervention utilizing a sensory integration-based approach have led to difficulties differentiating this approach from other unimodal or sensori-motor interventions (Parham et al., 2007). Creation of manualized intervention and fidelity measures have allowed for increased consistency in delivering sensory integration treatment in clinical and research settings through evaluation of structural and process components (Parham, et al., 2011; Schaaf & Mailloux, 2015). While fidelity measures and manualized interventions provide a framework for activities a practitioner should perform during sensory integration treatment, there is limited research on the quantification of specific behaviors exhibited by practitioners during daily practice intervention sessions. Efforts to quantify occupational therapy practitioners' actions have been focused on rating presence of several relevant behaviors during extremely small timeframes limited to a certain portion of the intervention (Dunkerley et al., 1997; Tickle-Degnen & Coster, 1995).

Using a retrospective practice-based methodology, this preliminary study aims to characterize and quantify moment-to-moment behaviors of therapists providing sensory integration treatment to children with an ASD diagnosis in a comprehensive manner across a large range of therapist actions and intervention sessions in clinical daily practice. This is important for identifying specific actions occupational therapy practitioners utilize when providing sensory integration treatment to young children with ASD in the context of daily practice. As practice-based research can bridge the gap between research and clinical practice, this knowledge could aid occupational therapy practitioners in delivering targeted sensory integration treatment for young children with ASD in clinical settings.

In addition to specific practitioner behaviors, we explore the activities occupational therapy practitioners emphasized and the therapeutic modes they utilized within sessions, as well as the overall engagement of the occupational therapy practitioners with clients to investigate additional qualities of behavior that may influence successful outcomes in sensory integration treatment. These relational qualities of treatment have been deemed important for intentional therapeutic interactions in occupational therapy (Taylor, 2008), but have limited research in sensory integration treatment. Investigating specific qualities of behaviors that are present during daily practice of this treatment with young children with ASD will provide a first step to identifying qualities which may influence provision and outcomes of treatment. Overall, this study provides detailed information about occupational therapists' moment-to-moment clinical actions when providing this treatment with young children with ASD.

Methods

Videotapes of Treatment Sessions

We requested videotapes of treatment sessions originally recorded for educational and/or clinical purposes from five Los Angeles (LA) occupational therapy clinics that are known for their expertise in providing sensory integration treatment. Though treatment in daily practice may not utilize only manualized approaches (i.e. Ayres Sensory Integration®) throughout sessions as is required for intervention in non-practice-based research, these five clinics comply with the structural and process elements of sensory integration treatment as originally developed by Ayres (1972). In accordance with these elements, the facilities from where the videos were obtained conduct record reviews for historical and current information, assessment results, and develop clearly stated goals prior to intervention as part of the facilities procedures. Additionally, communication with parents and teachers about the course of intervention and the child's performance and participation occurs routinely at these facilities. The clinics are located throughout the greater LA community and serve a diverse population. The clinics were chosen due to their long-standing relationships with the university. Clinical directors were approached, and letters of support for the research project were provided. We requested videos of expert practitioners providing sensory integration treatment with families who had agreed to videotaping of their child in the clinic for educational or clinical purposes, as well as having a diagnosis or concern of ASD, depending on age. The institutional review board at the University of Southern California approved this study.

Table 1. Representation of practitioners in videos.

Practitioner	Number of Videos	Number of Clients
1	4	1
2	5	1
3	9	2
4	2	1
5	4	1
6	4	2
7	3	1
8	3	1

Forty-two videos were acquired from the five clinics. Inclusion criteria for videos included that the treatment session was conducted in English, there was enough information to establish fidelity to sensory integration treatment (Parham et al., 2011), and used sensory integration treatment for a majority of the session time. Other occupation-based approaches may have been conducted for a portion of the full treatment sessions. If a full session was not captured on a video, the video was only included for analysis if sensory integration treatment was the only treatment approach used during the video. Thirty-four videotaped intervention sessions using sensory integration treatment were used for data analysis.

To confirm the videos collected across clinics included sensory integration treatment, the Ayres Sensory Integration Fidelity Measure (Parham et al., 2011) was used to review 20 percent of videos included in analysis prior to coding. The Fidelity Measures were completed through consensus scoring by a primary investigator and a PhD student with advanced training and expertise in sensory integration treatment. Structural Elements of the Fidelity Measure (therapist qualifications, safe environment, physical space and available equipment) were scored based on information obtained from the clinics. Process Elements were scored by reviewing the videotapes.

Participants

In these recordings, eight female occupational therapists provided sensory integration treatment to eight male clients and one female client with ASD aged between 18 and 56 months ($M = 33$ months) at the first recorded treatment session. For the 34 videos coded, the eight occupational therapists were represented in as few as two videos and as many as nine videos. Table 1 provides additional details on representation of the occupational therapists across videos. Training and experience of the occupational therapists was consistent with the Ayres Sensory Integration Fidelity Measure (Parham et al., 2011), as occupational therapists providing intervention in the clinics were required to have a minimum of 50 education hours in sensory integration theory and practice, and at least 1 hour per month of mentoring with an advanced-level occupational therapist for a year.

Measures

A coding system of 134 behaviors in 5 categories specific to the person conducting the intervention was created and refined over a period of a year in consultation with additional experts in sensory integration treatment and behavioral neuroscience. The 5

Table 2. Examples of coding definitions.

Category	Examples of Coding Definition
Provides Sensory Opportunities	<p>VESTIBULAR ACTIVITY: The therapist encourages the child's engagement in an activity that provide vestibular information or sets up an activity to promote vestibular input.</p> <p>PROPRIOCEPTIVE ACTIVITY: the therapist encourages child's engagement in activities that provide proprioceptive information or sets up an activity to facilitate proprioceptive input.</p> <p>TACTILE ACTIVITY: the therapist encourages child's engagement in activities or sets up an activity that provides tactile information.</p>
Activities & Challenges	<p>DRAWS ATTENTION TO CHILD (Feedback): The therapist tries to draw the child's attention to something that he/she is doing wrong, without specifically saying what it is.</p> <p>FINE MOTOR COORDINATION:</p> <ul style="list-style-type: none"> Therapist promotes: Object-to-object Therapist promotes: Person-to-object <p>POSTURAL CONTROL: The therapist creates an opportunity to work on postural control</p>
Interaction & Communication	<p>OFFERS: The therapist suggests an activity or offers an object or piece of equipment to the child.</p> <p>DECLARATION: The therapist verbalizes what she and/or the child are doing. This can be while they are doing it or during set-up of the activity.</p> <p>CALL NAME: The therapist calls the child's name to get his attention.</p>
Safety & Equipment	<p>LEVEL OF ASSISTANCE</p> <ul style="list-style-type: none"> Tactile facilitation: The therapist's hands remain on the child while the child is performing the task to ensure safety or facilitate movement. <p>REPOSITIONS SELF: The therapist moves or repositions herself for increased safety, visual contact, or physical support with the child.</p> <p>USE OF EQUIPMENT:</p> <ul style="list-style-type: none"> Checks equipment: The therapist checks that the equipment is well placed and safe.
Play & a Fun Environment	<p>NEW ACTIVITY WITHIN SESSION: The therapists suggests changing the activity the child is doing in the session to another activity. It can be something that the child has done before.</p> <p>MAKES NOISE: Therapist vocalizes a noise</p> <p>SINGS: Therapist sings with or to child</p>

categories were *Provides Sensory Opportunities*, *Activities & Challenges*, *Interaction & Communication*, *Safety & Equipment*, and *Play & a Fun Environment*. Behaviors in these categories were identified to encompass all practitioner actions, representing the principles most relevant to sensory integration treatment originally described by Ayres (1972), such as providing sensory opportunities, tailoring the challenges to the child's level of performance, capitalizing on the therapeutic alliance, delivering the intervention in a safe enriched physical environment, and promoting child directed activities and play. While these concepts were used as broad categories of behavior, only specific observable behaviors were included in the coding scheme.

Table 2 provides examples of categories of codes and examples of definitions included in the coding scheme. The category *Provides Sensory Opportunities* in the coding system

includes tactile, auditory, visual, vestibular and proprioceptive experiences. *Activities & Challenges* presented to the child, also referred to as the adaptive response, includes behaviors representing challenges in the motor, social, language, and regulation areas. The therapeutic alliance was represented primarily by the verbal and non-verbal communication existing between the therapist and the child in the *Interaction & Communication* category, as well as behaviors in the *Play & Fun Environment* category. *Safety & Equipment* included the clinicians' use of equipment and materials. An additional seventeen unique general impression quality ratings probed for concepts of engagement, therapeutic modes, and types of play for therapists and their activities. Three engagement ratings were adapted from the Adult Engagement Scale (Bertram, 1996; Laevers, 1994; Pascale et al., 1998). The six types of play the practitioner facilitated were adapted from Blanche (2002; Blanche & Knox, 2008), while therapeutic modes emphasized during intervention were adapted from the Intentional Relationship Model (Taylor, 2008). Each behavior or rating included was explicitly defined. A copy of the full coding scheme can be requested from the authors.

Coding of Videotapes

Two Masters' level students in occupational therapy and one PhD-level student in occupational science were trained in the coding system. Research assistants had 10-20 hours of training on the coding system with primary investigators as well as coding training videos with the primary "gold standard" coder. The research assistants coded the frequency and duration of therapists' behaviors through continuous sampling of the taped sessions with Observer XT 11 (Noldus Information Technology, Wageningen, The Netherlands), a manual event recorder that allows for detailed recording and analysis of behavioral processes (Noldus et al., 2000). Research assistants were trained to code only direct observations of the practitioner using the behavior definitions from the coding scheme, which was not dependent on mastery of sensory integration concepts. A minimal kappa threshold of 0.70 in each category of the coding scheme between primary and secondary coders was achieved in training videos before research assistants were assigned additional videos.

Three general impression rating scales of types of play, therapeutic modes, and for practitioner engagement during the treatment were also coded. Coders assigned ratings for each individual scale after completing coding of a session. General impression scores for types of play facilitated and therapeutic modes utilized a one to ten scale (1 = None or minimal emphasis on facilitating the type of play or therapeutic mode during the session; 10 = Significant emphasis on facilitating the type of play or therapeutic mode during the session; not dependent on a majority of time). Engagement ratings used a one to five scale (1 = Practitioner does not demonstrate the quality during the session; 5 = Practitioner always demonstrates the quality during the session).

Inter-rater reliability between the primary "gold standard" coder and two secondary coders was sampled on 20 percent of videos. Across communication behaviors, which included behaviors within the *Interaction & Communication* category, inter-rater reliability had a kappa of .76. Inter-rater reliability for activities included behaviors in the *Provides Sensory Opportunities* and *Activities & Challenges* categories and had a kappa of 0.74. Both kappas indicate substantial agreement between coders (Hallgren, 2012;

Viera & Garrett, 2005). Inter-rater reliability for general impression ratings was conducted through interclass correlations. Ratings for the type of play practitioners' facilitated had intraclass correlations ranging from 0.60 to 0.87, with a mean of 0.78, indicating moderate to good reliability (Koo & Li, 2016). Therapeutic mode ratings had intraclass correlations of 0.67 to 0.92 (moderate to excellent reliability) and had an mean of 0.80. The ratings of practitioner engagement intraclass correlations ranged from 0.89 to 1.00 (good to excellent reliability).

Data Analysis

Total counts and mean frequency of all behaviors were calculated for each video. To account for differences in video length, frequency of individual behaviors was converted to behavior per minute. For the purposes of this paper, these rates (behavior per minute) were multiplied by 50 to provide a transformed rate of occurrence in a time-frame that is often a typical session length for many pediatric private practice clinics, 50 minutes, which may be more meaningful for clinicians. As such, rates of clinicians' actions will be reported as activities or behaviors per 50-minute session.

Results

Sensory Experiences

Process Element Scores on the Ayres Sensory Integration Fidelity Measure (Parham et al., 2011) ranged from 93-100, with a mean Process Element Score of 97.3, exceeding the required total score of 80. Videod treatment sessions from these clinics met all requirements for the Structural Elements. Videos of treatment sessions coded ranged in length from 6.02 to 60.32 minutes, with a mean of 34.68 ± 2.59 (MEAN \pm SEM) minutes and a median time of 39.81 minutes. A total of 1179.02 minutes of sensory integration treatment were coded.

Total behaviors coded in videos ranged from 617.09 to 1412.98, with a mean of 979.35 ± 30.30 during the transformed 50-minute sessions. Table 3 reports counts and means of sensory-focused and frequently occurring occupational therapist behaviors across sessions of sensory integration treatment. On average 15.41 ± 1.45 different activities were presented during a session with a range of 2.24 to 33.22. Across the 34 intervention session videos, opportunities for proprioceptive or heavy work activities, such as climbing, occurred an average of 7.50 ± 1.19 times per session, the most of all sensory-based opportunities.

Vestibular opportunities (use of a swing) were the second most frequent sensory-based activities with an average of 4.30 ± 0.55 times per session. These opportunities included both occupational therapist facilitated and client initiated vestibular input. Therapists provided vestibular input by pushing a swing between 0 and 38.24 times with an average of 10.99 ± 1.70 times a session. They spent an average of 10.02 ± 2.14 percent, and up to 60.64 percent, of the session providing this input. Linear input (swinging front to back or side to side) was the most frequently provided vestibular input by the occupational therapists (8.44 ± 1.66).

Table 3. Quantification of selected therapist activities during sensory integration treatment.

	Range of Rate of Activity per Session	Mean Rate (SEM)
Facilitates:		
New Activity within Session	2.24–33.22	15.41 (1.45)
Vestibular Activity	0.00–12.93	4.30 (0.55)
Provided Vestibular Input	0.00–38.24	10.99 (1.70)
Proprioceptive/Heavy Work	0.00–31.08	7.50 (1.19)
Tactile Activity	0.00–15.82	2.54 (0.64)
<i>Tactile Activity, Body</i>		1.78 (0.54)
Fine Motor Coordination	0.00–44.14	14.48 (2.21)
Provides Assistance to Child	0.00–109.38	52.39 (5.03)
<i>Assistance, Tactile Support or Facilitation</i>	0.00–48.10	16.05 (2.15)
<i>Assistance, Hand over hand</i>	0.00–49.25	7.18 (1.88)
Communicates:		
Declaration	64.63–217.12	74.98 (4.38)
Offers	5.71–148.47	77.38 (5.84)
<i>Offers, One Choice</i>		72.99 (5.57)
Positive Command	7.91–312.31	113.44 (9.67)
What Will Happen	0.00–90.38	36.16 (4.00)
Makes Noise	5.90–167.43	51.14 (6.49)
Joint Attention	0.00–79.08	27.73 (3.79)
Correcting Feedback	0.00–97.14	27.89 (3.74)
Draws Attention to Child (Feedback)	0.00–48.35	21.59 (2.12)
Feedback Question	0.00–66.19	23.77 (3.30)
Positive Reinforcement	0.00–110.31	39.61 (5.50)

Tactile input opportunities (defined as application of specific tactile stimuli, i.e. playing in a ballpit or being squished by a large pillow) were limited across sessions, with therapists promoting these activities only an average of 2.55 ± 0.64 total times for a 50-minute session. When assisting children during activities, the occupational therapists provided tactile support or facilitation (defined as the therapist placing hands on a child for safety or to guide a child's movement) an average of 16.05 ± 2.15 times per session, while hand over hand (defined as the practitioner completes the movement for the child) occurred approximately 7.18 ± 1.88 times during a session. The occupational therapists promoted 0.00 to 44.14 (14.48 ± 2.21) opportunities for fine motor coordination per session (i.e. putting pegs in a board or reaching for small objects).

Communication

Declarations, verbal offers, and positive commands made by the occupational therapists were the highest occurring behaviors across all sessions of sensory integration treatment. Other frequently occurring communication behaviors included feedback, statements emphasizing what would happen next, and making noises appropriate to the activity. Across the sessions, the occupational therapists provided positive reinforcement 0 to 142.86 times with an average of 58.39 ± 4.91 times for a 50-minute session. Additionally, the occupational therapists made bids for joint attention with the child an average of 27.73 ± 3.79 times for a 50-minute session, with a range of 0 to 79.08.

General Impressions

General impression scores revealed the occupational therapists placed the highest emphasis on facilitating the child's mastery over tasks and games (6.14 ± 0.28), followed

Table 4. General impression scores of therapists providing sensory integration treatment across videos.

(1-10 Scale)	Mean (+/- SEM)
Challenge	6.06 (0.25)
<i>Therapist Facilitated:</i>	
Mastery over Tasks and Games	6.15 (0.28)
Pure High Intensity Play & Sensory Experiences	5.94 (0.39)
Quiet Play	4.47 (0.34)
Exposing Child to New Strategies or Repertoires of Interaction	4.58 (0.24)
Silly/Joking/Pure Fun	4.47 (0.25)
Creativity/Construction	3.65 (0.28)
<i>Therapeutic Modes:</i>	
Encouraging	6.09 (0.20)
Empathizing	5.74 (0.17)
Problem-solving	5.71 (0.32)
Collaborating	5.15 (0.28)
Instructing	5.11 (0.19)
Advocating	2.70 (0.22)
<i>Engagement (1-5 scale):</i>	
Sensitivity	4.03 (0.09)
Autonomy	3.97 (0.14)
Stimulation	3.74 (0.15)

by an emphasis on pure high intensity play and sensory experiences (5.94 ± 0.39). The occupational therapists accentuated an encouraging therapeutic mode (6.09 ± 0.20) during sessions. For engagement categories with a 1-5 scale, the occupational therapists scored highest in sensitivity (4.03 ± 0.09), followed by autonomy (3.97 ± 0.14). See Table 4 for full results of general impression scores.

Discussion

With growing evidence demonstrating efficacy of sensory integration treatment and the recent call for practice-based research, this study is timely in its efforts to explore intricate behaviors occurring within sessions of sensory integration treatment in clinical settings (Horn et al., 2012; Pfeiffer et al., 2011; Schaaf et al., 2014; Watling & Hauer, 2015; Weitlauf et al., 2017). This investigation appears to be the first of its kind to utilize this detailed method to quantify occupational therapy practitioners' actions during sensory integration treatment. Sensory integration treatment depends on these moment-to-moment decisions that are made by the practitioner (Schön, 2017), and the results from this study contribute to our understanding of this process. Furthermore, we have demonstrated that this is a reliable method for detailed analysis of practitioners' specific behaviors during sessions.

Sensory Experiences

Sensory activity counts and high mean scores for high intensity play and sensory experiences and mastery over tasks and games suggest alignment with Process Elements of sensory integration treatment, including assisting children during activities to ensure safety and presenting at least three sensory opportunities within tactile, vestibular, and proprioceptive domains and ensuring successful activities (Parham et al., 2011). Our results also demonstrate that sensory integration treatment conducted in a clinic setting

is multifaceted, with practitioners' facilitating a wide array of activities across intervention sessions, including sensory, gross motor, and fine motor activities.

Tactile opportunities were low compared to the frequency of vestibular and proprioceptive activity opportunities provided to children. This data aligns with results previously reported by Blanche (2017), which were obtained from data collected from clinical session notes. In the prior study by Blanche (2017), practitioners were asked to report the amount of time they spent working within each sensory domain, and proprioceptive and vestibular activities were reported the most. Practitioners reported minimal tactile involvement for activities, even when the practitioner noted tactile difficulties for the child. While our current retrospective study is limited by not knowing what specific problems these children with a diagnosis of ASD presented, or what specific problems on which the therapist was focused on improving, this pattern of data across these two studies may indicate a clinical emphasis on vestibular and proprioceptive inputs rather than an equal emphasis of all inputs. Future work should aim to understand if sensory opportunities are addressing the sensory integration challenges that were identified as impacting a child's performance or participation. The use of this detailed coding system could bring awareness to specific sensory integration challenges that are not adequately addressed during sensory integration treatment, if integrated with review of assessment, goals, and clinical notes in future studies.

Communication

The most frequently occurring behaviors observed during treatment sessions were communicative in nature, demonstrating that, in addition to providing sensory experiences, occupational therapy practitioners utilize verbal repertoires throughout sensory integration treatment, which can offer additional opportunities for social communication and interaction. Verbalizations occurring with high frequency aimed to provide descriptions and offers of actions, indicating attempts to facilitate engagement in activities. In addition, positive commands and reinforcement were common, while negative commands were limited, suggesting practitioners actively maintain a positive verbal interaction with their clients. The positive impression in communications supports the objective of occupational therapy practitioners working to establish a therapeutic alliance with the child (Parham et al., 2011). Additionally, during activity choice, practitioners often negotiated with the child or allowed the child to direct, if a specific preference for an activity had been given. This indicates that practitioners work to collaborate in activity choices as set forth originally by Ayres (1972) and in the fidelity measure developed by Parham et al (2011). These findings underscore that therapeutic alliance and rapport with children with ASD may play an essential role in sensory integration treatment, as it does in other interventions (Kerns et al., 2018).

General Impressions

We attempted to further our understanding of the engagement of occupational therapy practitioners with young clients with ASD and found high scores in sensitivity and autonomy. This indicates that practitioners displayed actions throughout the session

that conveyed positive affect, encouragement, and respect and value toward the child and to the child's initiations of ideas, choices, and judgment. Taken together, communication and engagement results suggest therapeutic alliance and engagement between the practitioner and child are fundamental aspects of sensory integration treatment. While these are consistent with core elements of the approach, these areas have not been extensively investigated or quantified for occupational therapy practitioners, the profession from which most therapists who provide sensory integration treatment are trained.

The high scores in sensitivity may indicate that sensitivity is a necessary component for constructive therapist-child interactions in sensory integration treatment. Other professions, such as psychotherapy and education, place significant emphasis on therapeutic alliance and frequently incorporate dyadic systems research in their understanding of clinician- or adult-child relationships and later outcomes (Lutz et al., 2007; Heatly & Votruba-Drzal, 2017). For instance, educational research has shown that adult sensitivity to children is a necessary condition for educative interactions to occur in early childhood education settings (Pascal & Bertram, 1999). While sensitivity may be needed for quality therapist-child interactions, the higher scores also may be a result of the occupational therapists in this study working with children with ASD, which could call for increased levels of sensitive behavior from the practitioners. Occupational therapy practitioners in this study displayed higher autonomy scores than early educators in prior research (Pascal & Bertram, 1999), which may be an indicator of the unique training and emphasis for occupational therapy and sensory integration treatment, as compared to other professions' training and goals.

These findings provide a starting point for identifying and understanding dimensions of engagement that underlie successful occupational therapy practitioner-child dyads. The coding scheme used in this study was developed in tandem with a coding scheme for child behavior and reaction to occupational therapy actions during intervention, which has been used in prior publications (Thompson & Blanche, 2015). While the focus of the current study was limited to only the occupational therapy practitioners' behaviors during intervention sessions, future studies will aim to merge the coding of children's behaviors with practitioners' behaviors to build a more comprehensive understanding of dyadic interaction during sensory integration treatment. Additional attention on this dynamic relationship within sensory integration treatment could better inform efficacy of this approach for young children with autism and other neurodevelopmental disorders.

Implications for Practice

Our findings demonstrate the need for combining quantification of practitioners' actions during intervention with systematic outcome measures to determine the role moment to moment clinical decisions have in the success of the intervention. Our data indicate that occupational therapy practitioners are providing several sensory opportunities and activities throughout the treatment sessions, as well as demonstrating behaviors, such as communications and sensitivity, that are meant to facilitate therapeutic alliance. Each of these actions may facilitate child outcomes through various mechanisms, and when combined with outcome measures, additional exploratory research can parse

which actions may potentially be active ingredients of a sensory integration treatment. Quantification of practitioners' activities allows for detailed analyses to provide insight into the relationships of specific gains children may make following intervention to particular actions from the occupational therapy practitioner that occur during sessions. This information can add to specificity of sensory opportunities and other elements needed to ensure maximally effective sensory integration treatment for all children, including those diagnosed with ASD or other neurodevelopmental disorders.

Limitations and Recommendations for Further Research

This study is limited by its retrospective nature and the lack of assessment and outcome information on the children involved in the treatment. Future studies will aim to incorporate this information. However, this study calls attention to the need for further investigation of sensory integration treatment using a multi-dimensional approach that places daily clinical practice at the center. Practice-based research considers the practice reality, including the facility contexts and existing policies practitioners must practice (Dodd & Epstein, 2012). It provides a mechanism to identify problems that occur in everyday practice, to demonstrate effectiveness of treatment in real settings, and to generate new clinical questions and explore the interface between practitioner and client (Westfall et al., 2007).

Practice-based research can build evidence for sensory integration treatment that considers how occupational therapy practice occurs in clinical settings that provide this approach as there may be variability in practice that occurs across settings, which can supplement traditional research efforts that minimize variability by design. This practice-based study demonstrates the range of detailed actions occupational therapists use during sensory integration treatment. In future studies, this information can be used in combination with the child's initial evaluation data and practitioners' self-appraisal and clinical notes to determine whether the child's presenting sensory issues are addressed during specific sessions of sensory integration treatment. This combinational approach may help practitioners analyze and improve their own clinical reasoning with active reflection.

Using this practice-based research approach, future work can begin to determine how the type and frequencies of practitioner actions are related to positive outcomes for young children with ASD during sensory integration treatment within real-world settings by integrating practitioner actions with child actions and outcomes, and ultimately provide the most benefit to individuals receiving intervention using sensory integration treatment. Practice-based research calls for continuous communication between practitioners and researchers for furthering findings of research and developing clinical questions to research. Collaboration between researchers and practitioners through practice-based research will further contribute to knowledge mobilization and high quality care in daily clinical practice.

Conclusion

This preliminary study provides detailed information about specific behaviors of occupational therapy practitioners during sensory integration treatment with young children

with ASD. Practitioners demonstrated a variety of communication actions and provided opportunities for sensory activities, promoting more vestibular and proprioceptive input opportunities. Practitioners emphasized mastery over tasks and games and high intensity sensory experiences during the sessions, and they exhibited high levels of encouragement and sensitivity with young children with ASD. Increased understanding of practitioner actions has the potential to illuminate the minute-to-minute response of the practitioner to the child's actions during sensory integration treatment. It is within these interactions where clinical reasoning and quality of treatment could be assessed and assist in individualizing and standardizing intervention in the future.

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