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The sensory profile: Comparative analysis of children with specific language impairment, ADHD and autism

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ABSTRACT

The Sensory Profile is useful in assisting with diagnosis of certain conditions which present with different sensory processing patterns. The purpose of this study was to compare the Sensory Profile for children with Specific Language Impairment (SLI) (n=22) to a typical pattern, as well as the reported profiles of samples with autism and Attention Deficit/Hyperactive Disorder (ADHD). The SLI sample had significantly more sensory processing difficulties than the typical population in all aspects. The Sensory Profile for both the autism and ADHD samples differed significantly from that of the SLI sample for H. Modulation Related to Body Position and Movement and Factor 6: Poor Registration. The SLI sample showed fewer sensory processing problems except for J. Modulation of Sensory Input Affecting Emotional Responses, M. Behavioural Outcomes of Sensory Processing and Factor 9: Fine motor/perceptual indicating that this small sample of children with SLI did present with a unique Sensory Profile pattern.

INTRODUCTION

The Sensory Profile developed by Winnie Dunn is a measure of sensory processing and has been widely used both clinically and in research to gain information on how children process sensory information from the body and the environment[1]. The information gained from the Sensory Profile provides information on the contribution of sensory processing to a child's daily performance. It provides information regarding behavioural tendencies in response to stimuli and identifies which sensory systems are likely to contribute to, or create barriers during functional activities[2]. Studies using the Sensory Profile propose that children with certain dysfunctions respond differently to sensory stimuli than children without dysfunctions[2-5]. It is assumed that children with certain dysfunctions process sensory information differently.

Research indicates that there are specific patterns of sensory processing consistent with the diagnostic criteria for children with autism and children with Attention Deficit Hyperactivity Disorder (ADHD)[2,3,6,7]. It is however not known whether a similar consistent pattern of sensory processing is present in other dysfunctions, like Specific Language Impairment (SLI), where behaviours similar to those associated with autism and ADHD are also observed[8,9].

Literature review

The development of the Sensory Profile progressed from the ground breaking work that was initially done by Jean Ayres on sensory integration[10]. Sensory integration results from the brain's ability to process and integrate sensory information received from the environment and from the body[10]. The main contributors to sensory integration as described in the work of Ayres are the tactile, vestibular and proprioceptive systems, but does not exclude the visual, auditory, olfactory and taste senses[10]. There is an ongoing debate on the use of terminology but this article describes sensory processing according to Dunn's research and published work on this concept[11].

Thus for the purposes of this research the processing of sensory input refers to the functions the nervous system used to receive, regulate, and organise sensory input according to the neurological threshold of a child[12]. Sensory modulation is the ability to regulate sensory information and to generate an appropriate response that matches the demands and expectations of the environment[12]. It further plays a role in regulating the habituation and sensitisation of the person's responses to sensory information from the body and the environment[13]. Dunn further proposed that, in order to produce functional behaviour, modulation of information needs to create an interchange along a continuum of habituation and sensitisation[1]. When a child has difficulty modulating between habituation and sensitization, they present with maladaptive behaviours, for e.g. they can present as being over excitable, hyperactive or overly lethargic[10]. However when the impact of neurological thresholds on the behavioural responses is considered, a range of possible

interpretations of these behaviours emerge, depending on the effect of the high or low thresholds on performances[1]. Children with a low neurological threshold often display the over excitable or hyperactive behaviours while over habituation can occur when a high neurological threshold is present resulting in overly lethargic and inattentive behaviour. The conceptual model developed by Dunn considers the relationship between neurological thresholds and behavioural (self-regulation) strategies[1,11]. Four basic patterns of responding to sensory events in everyday life were identified: low registration, sensation seeking, sensory sensitive and sensation avoiding[1,11]. These patterns are identified through the use of the Sensory Profile, a 125 item, behavioural questionnaire that is completed by a child's caregiver[11].

Various studies have been done to determine if the Sensory Profile could discriminate between different diagnostic groups[2-4,6,7,13,14]. In a study by Dunn and Bennett[3] the researchers evaluated 70 children with ADHD to compare their sensory processing patterns to that of typically developing children, using the Sensory Profile. Multivariate analyses of variance (MANOVA) indicated that the children with ADHD showed differences in all 14 sections of the Sensory Profile. The Sensory Profile was found to discriminate best between the high incidence factors like sensory seeking behaviours, inattention and distractibility and low incidence factors like oral sensory sensitivity and fine motor perceptual behaviour in children with ADHD[3]. This led them to believe that the Sensory Profile can be useful in discriminating between ADHD and typical children[3].

Kientz and Dunn[4] found that children from the autistic population showed different responses to the typically developing children population in 84 of the 99 items on the Sensory profile[4]. Similar findings in studies by Brown, Leo and Austin[7], Ermer and Dunn,[2] Provost et. al.[6], Tomchek and Dunn[15], Watling, Deitz and White[16] confirmed that there are significant differences in the way that children with autism process sensory input. Ermer and Dunn[2] further states that factor analytic studies indicated that children from the autistic population have a low incidence of behaviours on Factor: 1 *Sensory seeking*. This however was disputed by the findings by Tomchek and Dunn[15] who found that 90% of the their sample of children with autism had a high incidence of sensory seeking behaviours.

In New Zealand a study by Provost et.al.[6], found that children with autism experienced more difficulties with oral sensory sensitivity and obtained more definite different scores on all 14 sections than typical children. Provost et. al.[6] and Dunn et. al.[14] found similar results with Dunn et. al.[14] also showing that visual processing proved to be a strength for these children. Further studies by Brown et.al.[7] in Australia and Watling et. al.[16] also found that children with ASD more frequently have hypersensitivity to tactile processing and auditory input and they are hyposensitive to movement input.

Although there is a lack of consistency in the research studies in regards to the sample sizes, the use of the Sensory Profile or the Short Sensory Profile, the findings were very similar and confirm that children with autism all scored definite differences in patterns of sensory processing on the Sensory Profile on almost all items. No studies have been published on the Sensory Profile for children in other diagnostic groups such as Specific Language Impairment (SLI).

Specific Language Impairment

Specific Language Impairment (SLI) is a common neuro-developmental disorder, diagnosed when children present with expressive or receptive language impairment which is not due to intellectual disability, physical disability, hearing loss, emotional problems or environmental deprivation[16-18]. It is among one of the most commonly occurring communication disorders or developmental problems in children between the ages of 5-10 years in England and the United States where it is estimated that 5 - 7% of typically developing children experience speech and language difficulties[19]. Children with SLI present with a specific or primary speech and language impairment and although clinical identification of these impairments is based on the absence of other contributing factors the diagnosis needs to be confirmed by a speech and language therapist following a full assessment[17].

According to Tomblin[9] SLI is diagnosed when the achievement of age appropriate language levels fall at least -1 Standard Deviation (SD) below the norm. The International classification of disease version 10 (ICD-10) further states that a disorder or delay in developmental speech and language is strongly related to biological maturation of the central nervous system and in most cases the functions affected are language, visio-spatial skills and motor coordination[18].

Although a number of studies on SLI deal with controversies about language acquisition and use, such as difficulties in auditory processing, learning the rules of language and registering the different contexts for language, research has also reported other characteristics common to children with SLI[19,20]. These characteristics, which are non-linguistic, include poor social skills, a lack of attention[21], difficulty with fine and gross motor skills[22] and poor short term memory[21]. Difficulties with planning, organising and sequencing of thoughts and problems with beginning and completing tasks are also features of this condition[23].

Sensory processing and language

Hulslander et. al.[8], found a possible association between speech and language disorders and sensory processing difficulties in some children and proposed that there could be a link between chronic disorganisation in terms of behaviour and difficulties with vestibular, tactile and auditory processing in children with SLI[8]. This connection was supported by Ayres who described how the CNS mediates language development and that speech and language are seen as an end product of sensory integration[10].

The difficulties children with SLI experience particularly in modulating the amount of sensory input they receive and their disturbed auditory processing have been identified as a potential risk for the development of speech and language disorders[24]. A problem in this type of processing presents as inconsistent awareness of sound and is commonly found in conjunction with other dysfunctions that manifest as attention seeking, temper tantrums, hyperactivity, impulsivity and oppositional behaviours[25].

Owens[26] also described a possible the link between poor auditory processing and poor self-regulation which results in behaviours like daydreaming, problems in sitting still, completing assignments and increased anxiety. Other research has also suggested that there could be a link between chronic disorganisation in terms of behaviour and speech and language and that children with SLI may also have vestibular and tactile processing problems[17].

Problem statement: Research studies indicated that children with certain specified dysfunction respond differently from children without dysfunction on the Sensory Profile, suggesting underlying sensory processing and modulation difficulties which are reflected in their behavioural and emotional responses[9]. This then raised the question as to whether children with speech and language disorders, specifically SLI will also demonstrate differences on the Sensory Profile and if there are certain characteristics or patterns that are commonly associated with this condition?

The purpose of this study was therefore to determine the Sensory Profile for a group of children with SLI and to compare their profile to children with and without dysfunction.

The following research question was addressed:

- Does a significant difference exist between the Sensory Profile scores of children with SLI and those profiles published for children who are typically developing, children who have autism and children with ADHD?

Methodology

A quantitative, descriptive cross sectional research design was used in that children in the study were assessed at one time using the Sensory Profile. The study was conducted over the period of a year in Greater London and the South of England. To ensure that no ethical issues were raised regarding service delivery following assessment, parents were provided with an electronic report to give to their local therapist and referrals were made to OT services if the Sensory Profile indicated definite difficulties.

Ethical clearance was obtained from the Ethics committee for Research on Human Subjects at the University of the Witwatersrand. Further permissions were obtained from the schools and the participants.

Criteria for participant selection

The criteria for inclusion were that the children should be English speaking and between the ages of 5 years and 10 years 11 months. This age criterion was used as the Sensory Profile is standardised on an English speaking population of children aged 5 years to 10 years 11 months. A primary speech and language disorder (SLI), as identified by a speech and language therapist, had to be present as well as a statement of special educational needs (this is a formal document that describes a child's learning difficulties and the educational input that will be needed. It also includes details of the therapeutic input and type of school placement required). This criterion was important in order to ensure that the children identified for this study were also known to the special needs educators and therapists.

Exclusion criteria included children diagnosed by a paediatrician as having autism, Autistic Spectrum Disorder, ADHD, epilepsy, a cognitive disorder, Cerebral Palsy or developmental delay as these children may have sensory processing difficulties[2-4,7].

Data collection: Through the Department of Education in the UK**,** special schools for children with speech and language disorders and mainstream schools with a language unit/base in Greater London and the South of England were identified for participation. The sample of children was identified by the speech and language therapist and occupational therapist within each school and all children meeting the inclusion criteria in these schools were invited to participate. Letters requesting participation in the study were sent out to the parents. On receipt of consent from the parents the Sensory Profile questionnaires, as well as the Developmental profile II (DP-II), were sent to parents for completion. The parents had the option of contacting the researcher by phone or e-mail for assistance in completing the forms. A total of 260 questionnaires were sent out, but only 16 questionnaires (6%) were returned to the researcher, despite parents being reminded via e-mail twice during the process. As this sample was too small, a second request for participation was sent out and another eight of this group responded. Therefore only 24 out of a total of 320 (7.5% return rate) of the Sensory Profile questionnaires were used for data analysis. This small sample is a limitation in this study and may well have affected the internal validity as well as the external validity of the study and therefore results cannot be generalised to the population.

Instruments used: The Sensory Profile is a judgment based caregiver questionnaire consisting of 14 sections (total of 125 items), that reports the frequency of behavioural occurrences that are used to measure the patterns of performance indicative of difficulties experienced in sensory processing[11].

The DPII includes 186 items that assesses the development of the child in five areas; physical age, self-help age, social age, academic age and communication age. This test was used to determine if the children selected had any pervasive developmental delays[27]. Background information (chronological age, developmental age, gender, grade, diagnosis and type of speech and language impairment) of each participant was collected from the demographic information section on the Sensory profile scoring sheet.

Data Analysis: The data from the questionnaires were placed onto an Excel spread sheet and then analysed, using descriptive statistics and the t-test. The raw scores from the Sensory Profile were determined through adding all scores for a section. The mean and standard deviation values were then determined per group for each section total on the profile[11]. Scores that fell within the probable difference (below – 1 SD), as well as the definite difference range (below – 2SD) were considered to be indicative of a problem[11].

The percentage of children who fell in a specific group (typical, probable difference and definite difference) was then determined for comparison between the groups.

The raw scores for the typically developing children, children with ADHD and children with autism were obtained from the literature in order to compare them to this study sample[3,4,11]. Parametric testing (t-test analysis) was used to establish if there were significant differences between the mean raw scores of the SLI group and those of typically developing children[1], those with ADHD in studies carried out by Dunn and Bennet[3] and those with autism in the study by Kientz and Dunn[4].

RESULTS

Only 24 questionnaires were returned from the SLI children and the scores of two participants could not be used as the Developmental Profile II indicated that they had developmental disorders. This poor return rate of 20% was below the accepted level of 60% for a mail survey and affected the external validity and the internal validity of the study[28]. The sample size is in line with previous research done to identify unique sensory profiles for different diagnostic categories the results of this study must however be viewed with caution[2,4,6,7]. The larger standard deviations obtained for all aspects of the Sensory Profile when compared to the other groups indicate larger variations in the sample of children with SLI than those obtained in the other studies and further confirmation of these findings on a larger sample is needed.

Demographic information indicated that eight children were females and 14 were males with an age range of 5 years 1 month to 10 years 8 months and a mean age of 8 years 2 months. More than half of all the children had received occupational therapy and all were being treated by a speech and language therapist.

Sensory profile results

Data analysis revealed that the sample of children with SLI had unique patterns of sensory responsivity with the raw scores of all scores patterns on the Sensory Profile being significantly lower ($p \leq 0.00$) than those reported for the typically developing child, indicating possible sensory processing difficulties in children with SLI for all components measured on the Sensory Profile[4] (*Table I* on page 37).

Considering the score patterns pertaining to the percentage of the sample of children with SLI that scored within the probable difference or significant difference ranges (indicating difficulties) on the Sensory Profile, the statistical analysis did indicate that the sample of children with SLI had difficulty with all areas of **sensory processing** (multi-sensory processing (81.82%) and auditory processing (68.1%), as well as vestibular, touch and oral processing (54.44%). Visual processing proved to be an area of strength for the sample (only 45.45% experienced difficulties) (see *Table II*).

In the modulation score pattern, these children had lower raw scores on all modulation scores than the typical sample and 54.45% had difficulty with **modulation** of sensory input affecting emotional response and 81.82% of the sample had difficulty with **modulation** of movement affecting activity levels (see *Table II*).

Behaviour and emotional response patterns on the Sensory Profile proved to be problematic for the sample of children with SLI with all raw scores falling below that of the sample of typically developing children and more than 50% of the sample presenting with difficulties in terms of behavioural and emotional responses.

Responsiveness score patterns as seen in the factor scores indicated that these children also experienced difficulties with **Factor 5: Inattention and distractibility** (81.82%), **Factor 9: Fine motor/perceptual** (72.73%), **Factor 2: Emotionally reactive** (63.64%) and **Factor 1: Sensory seeking** (54.54%) (see *Table II*).

A comparison of Sensory Profile of the sample of children with SLI to other samples of children with autism and children with ADHD disclosed differences in performance between the these samples and children with SLI in the reported patterns on the Sensory Profile[3].

Results indicated that the raw scores for SLI, autism and ADHD fell below those of typically developing children and that children

with autism had the lowest scores in all of items on the Sensory Profile.

Table 1 indicates that the scores for the sample of children with SLI were significantly higher under the **sensory processing** section for **D. Touch Processing** ($p \leq 0.00$), **F. Oral Processing** ($p \leq 0.03$) than the sample of children with autism's scores.

The **modulation score patterns** of the sample of children with SLI are similar or less dysfunctional than those of the sample of children with ADHD except for **J. Modulation of Sensory Input Affecting Emotional responses** where the scores for the sample

Table 1: Comparison of Sensory Profile mean scores for SLI, typically developing children[11,13], autism[4], and children with ADHD[3]

Sensory Processing	Speech Mean	SD	Typical Mean	SD	p	Autism Mean	SD	p	ADHD Mean	SD	p
A. Auditory processing	25.8	7.0	33.1	3.8	**0.00**	25.0	5.1	0.63	23.8	5.4	0.16
B. Visual Processing	32.8	6.5	37.4	4.2	**0.00**	30.6	6.0	0.21	30.5	5.7	0.11
C. Vestibular Processing	45.0	7.5	51.7	3.1	**0.00**	42.8	4.7	0.19	42.7	7.2	0.19
D. Touch Processing	70.2	11.7	81.6	7.2	**0.00**	60.1	10.6	**0.00**	65.4	10.1	0.06
E. Multi-sensory Processing	23.0	4.6	30.4	2.7	**0.00**	20.7	4.3	0.06	22.3	3.8	0.47
F. Oral sensory processing	44.6	11.4	53.0	6.4	**0.00**	38.2	10.0	**0.03**	44.4	9.8	0.93
Modulation	**Speech Mean**	**SD**	**Typical Mean**	**SD**	**p**	**Autism Mean**	**SD**	**p**	**ADHD Mean**	**SD**	**p**
G. Sensory processing related to Endurance/Tone	35.4	9.4	42.5	3.5	**0.00**	34.4	8.7	0.69	36.9	8.0	0.46
H. Modulation Related to Body Position & Movement	40.3	8.2	45.7	3.5	**0.00**	35.9	5.5	**0.02**	36.6	6.7	**0.04**
I. Modulation of Movement affecting activity Level	22.5	3.9	27.0	3.5	**0.00**	21.4	3.2	0.26	21.8	4.0	0.47
J. Modulation of Sensory Input Affecting Emotional Responses.	12.4	3.4	18.1	1.9	**0.00**	11.7	2.9	0.42	14.3	2.7	**0.01**
K. Modulation of Visual Input Affecting Emotional Responses and Activity Level	13.8	3.4	16.8	2.1	**0.00**	12.6	2.4	0.13	12.6	2.7	0.10
Behaviour and Emotional Responses	**Speech Mean**	**SD**	**Typical Mean**	**SD**	**p**	**Autism Mean**	**SD**	**p**	**ADHD Mean**	**SD**	**p**
L. Emotional/Social Responses	57.1	11.9	70.6	9.0	**0.00**	50.9	8.4	**0.03**	53.0	9.6	0.10
M. Behavioural outcomes of Sensory Processing	16.9	4.7	25.2	2.9	**0.00**	16.9	3.1	1.00	19.3	3.9	**0.02**
N. Items indicating Thresholds for Response	10.9	2.5	13.4	1.5	**0.00**	10.1	2.8	0.28	10.0	2.3	0.12
Factor scores	**Speech Mean**	**SD**	**Typical Mean**	**SD**	**p**	**Autism Mean**	**SD**	**p**	**ADHD Mean**	**SD**	**p**
1. Sensory Seeking	58.1	11.5	74.1	7.3	**0.00**	56.1	10.4	0.51	51.9	12.5	**0.04**
2. Emotionally reactive	48.6	12.0	65.2	9.1	**0.00**	43.0	8.3	**0.05**	46.0	10.2	0.32
3. Low Endurance tone	35.4	9.4	42.3	3.5	**0.00**	34.4	8.7	0.69	36.9	8.0	0.46
4. Oral sensory sensitivity	33.1	9.6	39.2	5.4	**0.00**	30.5	7.0	0.25	33.5	8.3	0.84
5. Inattention/Distractibility	19.4	5.8	27.9	3.7	**0.00**	19.9	4.3	0.72	18.0	4.6	0.25
6. Poor registration	34.1	4.6	36.7	3.4	**0.00**	27.5	5.2	**0.00**	30.9	4.5	**0.01**
7. Sensory Sensitivity	16.8	3.7	18.4	2.1	**0.00**	15.0	4.5	0.13	16.6	3.2	0.81
8. Sedentary	13.5	4.4	15.0	2.6	**0.03**	12.9	3.4	0.57	13.7	3.5	0.83
9. Fine motor/perceptual	7.5	3.3	13.4	1.8	**0.00**	7.1	2.3	0.60	9.6	2.5	**0.00**

of children with SLI were significantly ($p \leq 0.01$) lower (*Figure* 2). The scores for **H. Modulation related to body position and movement** compared to the sample of children with autism's profile ($p < 0.02$) and the sample of children with ADHD's profile ($p < 0.04$) were significantly lower than the sample of children with SLI.

A similar trend for **behavioural scores** was observed. The sample of children with SLI had higher raw scores than the sample of children with ADHD except for the scores for **M. Behavioural Outcomes of Sensory Processing** ($p \leq 0.02$) and **L. Emotional and Behavioural Responses** when compared to the sample of children with autism ($p \leq 0.03$).

Table 2: Sensory Processing, Modulation, Behavioural and emotional response and factor scores for the children with specific language impairment

	Typical performance %	Probable difference %	Definite difference %	Combined Probable and Definite difference %
Sensory Processing				
A. Auditory processing	31.82	9.09	59.09	68.18
B. Visual Processing	54.55	36.36	9.09	45.45
C. Vestibular Processing	45.45	13.64	40.91	54.55
D. Touch Processing	45.45	18.18	36.37	54.55
E. Multisensory Processing	18.18	27.27	54.55	81.82
F. Oral sensory processing	45.45	13.64	40.91	54.55
Modulation				
G. Sensory processing related to Endurance/Tone	50	18.18	31.82	50
H. Modulation Related to Body Position & Movement	59.09	18.18	22.73	40.91
I. Modulation of Movement affecting activity Level	45.45	45.45	9.09	54.54
J. Modulation of Sensory Input Affecting Emotional Responses.	18.18	13.64	68.18	81.82
K. Modulation of Visual Input Affecting Emotional Responses and Activity Level	54.55	27.27	18.18	45.45
Behaviour and Emotional Responses				
L. Emotional/Social Responses	45.45	18.18	36.37	54.55
M. Beahvioural outcomes of Sensory Processing	22.72	13.64	63.64	77.28
N. Items indicating Thresholds for Response	40.91	31.82	27.27	59.09
Factor				
1. Sensory Seeking	45.46	27.27	27.27	54.54
2. Emotionally reactive	36.36	22.73	40.91	63.64
3. Low Endurance tone	50	13.64	36.36	50
4. Oral sensory sensitivity	63.64	13.64	22.72	36.36
5. Inattention/ Distractibiliy	18.18	13.64	68.18	81.82
6. Poor registration	72.73	4.55	22.72	27.27
7. Sensory Sensitivity	72.72	13.64	13.64	27.28
8. Sedentary	72.73	9.09	18.18	27.27
9. Fine motor/ perceptual	27.27	18.18	54.55	72.73

On all factor scores the sample of children with SLI scored higher scores except for **Factor 9: Fine motor/perceptual** which was significantly lower ($p \leq 0.00$) than the sample of children with ADHD. The factor scores that were significantly higher for the sample of children with SLI were **Factor1: Sensory seeking** ($p \leq 0.04$) and **Factor 2: Emotionally reactive** ($p \leq 0.05$) for those of children with ADHD and autism respectively (*Figure* 2). Similar results were found for the scores for **Factor 6: Poor Registration** ($p \leq 0.00$ and $p \leq 0.01$).

DISCUSSION

In the study by Brown et. al.[7] the researchers suggested that the Sensory Profile is able to discriminate between groups of children with disabilities and typically developing children. This study investigated the differences in raw scores between samples of children with SLI, children with autism and children with ADHD on the items of the Sensory Profile.

Children with Specific Language Impairment compared to Typically developing children

The results of this study suggest that the participants with SLI show a significant difference on all items of the Sensory Profile when compared to typically developing children. As a lower raw score is an indication of difficulties it is possible to say that there is a significant difference between the sample of children with SLI and typically developing children. Thus for the sample of children with SLI in this study it can be presumed that they present with sensory processing dysfunction.

Children with Specific Language Impairment compared to children with Attention Deficit Hyperactivity Disorder

In light of the many similar problems described in relation to children with SLI and children with ADHD, it had been expected that the sample of children with SLI would have a Sensory Profile similar to that found for the children with ADHD[29,30]. The results of this study indicated that overall the sample of children with SLI and children with ADHD have similar patterns of processing sensory information; but however indicated that there were some areas with significant differences in raw scores between the sample of children with SLI and children with ADHD (*Table 1*).

The raw scores for **H. Modulation Related to Body Position and Movement** were found to be lower in the sample of children with ADHD indicating that they engage in this behaviour (take movement risks, excessive movement, seeks opportunity to fall etc.) more often than the sample of children with SLI. A possible explanation could be that children with ADHD are not registering sensory input effectively and are therefore constantly seeking more sensory input in order to generate responses for movement[3]. The lower raw scores on **Factor 6: Poor registration** could possibly be proof of their difficulty with registering information from the environment. Dunn proposed that children with poor registration may have inadequate neural activation, which can result in sensory seeking behaviour[9,13], and that children with ADHD use sensory seeking behaviour to enable their learning. Further confirmation of this could be that factor scores indicated that the sample of children with ADHD had significantly lower scores for **Factor 1: Sensory seeking**, indicating that they are engaging more in sensory seeking behaviour.

Children with ADHD often have difficulties with behaviour due to their inability to focus, high activity levels and impulsivity[29]. It was thus expected that differences in items scoring behaviour would be lower than that of the sample of children with SLI. The raw scores on **M. Behavioural outcomes of sensory processing** were however significantly lower in the sample of children with SLI than in the sample of children with ADHD. The sample of children with SLI also had significantly lower scores on **J. Modulation of sensory input affecting emotional responses.** This may be explained by the fact that speech and language are an end product of sensory integration and it is therefore proposed that the children with SLI who experience difficulties with sensory processing will find it more difficult to meet the demands set by the environment which will then result in more emotional responses such as frustration and emotional outbursts[10].

The significantly lower scores found in the sample of children with SLI for **Factor 9: Fine motor/perceptual** is also congruent with the reported characteristics of children with SLI[25]. This agrees with the findings of Kruger et al. that children with language disorders have problems with fine motor skills, whereas children with ADHD tend to experience more visuo-motor and perceptual difficulties[3,15].

Children with Specific Language Impairment compared to children with Autism

As children with autism also have severe speech and language difficulties it is very important to distinguish between children with autism and children with SLI when establishing a diagnosis[17,31]. Research indicated that children with autism process sensory information in a different way to typically developing children[4-7].

Factor analytic studies indicated that they have a low incidence of behaviours on **Factor: 1 Sensory seeking**, and a high incidence of oral processing and behaviours on **Factor 4: Oral sensory sensitivity, Factor 5: Inattention** and **Factor 9: Fine motor/perceptual**, that contributed to the differences found in children with autism from typically developing children[2].

Dunn et. al.[14] described children with autism as having more difficulties with oral sensory processing and that visual processing proved to be a strength for this sample. According to the literature, oral processing was found to be the most discriminating for children with autism[14] and they are described as experiencing oral sensitivity to particular tastes, textures and smells.

The sample of children with SLI presented with significantly better mean raw scores for both oral processing and oral sensory sensitivity than the autistic group, although they scored lower than the typical group. It had been expected that the sample of children with SLI might have difficulties with oral processing, as oral processing also plays a role in the development of speech (the production of sound, placement of the tongue and lips, pressure of the lips etc. when producing words)[32]. Their problems however appear to differ from and are not as severe as those found in children with autism which means this item can be used to differentiate children with SLI from those with autism.

Touch processing was found to be dysfunctional in children with autism and in a study by Baranek, Foster and Berkson[33] it was found that these children tend to experience more difficulties with tactile defensiveness. Thus not unexpectedly the sample of children with autism appear to be much more sensitive to touch input resulting in more rigid and inflexible behaviour related to dependence on a specific routine[10]. The significantly higher scores for **D. Touch processing** in the sample of children with SLI means they have less sensitivity to touch input resulting in less rigid and inflexible behaviour. This is another item which can be used to discriminate between children with SLI and autism as can **H. Modulation Related to Body Position and Movement** scores which were also significantly lower for the sample of children with autism than the sample of children with SLI. This aspect of sensory processing is manifest in children with autism when they display repetitive motor movements like whole body rocking or jumping in one place[10].

The **emotional/social** section of the Sensory Profile measures the child's psychosocial coping strategies. Significant differences in raw scores on **L: Emotional/social responses** and **Factor 2: Emotional reactive** indicated that the sample of children with autism found emotional responses more difficult to control. This was not unexpected as children with autism are expected to have more problems in this aspect as one of the difficulties they experience is transitioning from one activity to the next. They further experience frustration, which can lead to subsequent emotional outbursts. The raw scores for **Factor 6: Poor registration** was significantly lower for the sample of children with autism than the samples of children with ADHD and SLI. This can probably be explained by what literature describes as children with autism "being in their own

world", not aware of what is going on around them, especially when they are over focused on an object or part thereof[4,31].

Even though this study was limited by a poor response rate, lower than the accepted 60%, the results suggest that significant differences were found between the sample of children with SLI and typically developing children and that the SLI sample do have a specific sensory profile.

CONCLUSION

The pattern of performance of the sample of children with SLI on the Sensory Profile showed significant differences to that of typically developing children with several differences being found when compared to the a sample of children with autism and a sample of children with ADHD. The children with autism had more difficulties than the children with SLI on all sections of the Sensory Profile whereas the differences between the children with SLI and the children with ADHD varied.

Although the small sample size was a limitation, the study did provide provisional information to indicate differences between these populations. Therefore further research with a larger sample size will be of value to confirm the results of this study. The literature indicates that identifying the differences between dysfunction on the Sensory Profile can assist in discriminating between different groups and can therefore assist in the process of obtaining a diagnosis. This will be helpful in determining a differential diagnosis for children with SLI, autism and ADHD as all three groups have difficulties with speech and language, but have different sensory processing issues.

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