

Treatment of sensory defensiveness in adults

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ABSTRACT: *This pilot study explored the relationship between sensory defensiveness and anxiety, as well as the impact of a sensory integration treatment protocol on normal adults. Fifteen adult subjects identified as having sensory defensiveness completed the Adult Sensory Questionnaire (ASQ), Adult Sensory Interview (ADULT-SI), and Beck Anxiety Inventory (BAI) at pre-test and post-test intervals to measure sensory defensiveness and anxiety. A treatment protocol was implemented which included providing insight into sensory defensiveness, regular and daily sensory input, and engagement in activities of choice providing primarily proprioceptive, vestibular and tactile sensory input. Subjects engaged in an individualized self-treatment protocol for one month.*

Results indicated a significant correlation between anxiety and sensory defensiveness ($r = 0.62$, $p = 0.027$). The differences in pre-test and post-test mean scores of the Adult Sensory Interview ($p = 0.048$) and the Beck Anxiety Inventory ($p = 0.0453$) supported the use of a sensory treatment protocol to decrease sensory defensiveness and secondary anxiety. There is a need for further research using experimental methodology with a control group to explore the effectiveness of a sensory treatment protocol on sensory defensiveness and anxiety.

Key words: sensory defensiveness, anxiety, Adult Sensory Interview

Introduction

Sensory defensiveness is a negative reaction to certain sensory inputs (i.e. tactile, vestibular, auditory, visual, gustatory, olfactory or proprioceptive), which would not normally be interpreted as aversive (Wilbarger and Wilbarger, 1991). Jean Ayres (1964) initially described this phenomenon in the literature in the 1960s. Sensory defensiveness is considered the behavioural manifestation of over-responsivity, a

dysfunction in sensory modulation. Sensory modulation dysfunction is 'a problem in the capacity to regulate and organize the degree, intensity, and nature of response to sensory input in a graded manner' (Lane et al., 2000).

Dunn (1997) provided a framework in which to understand the neurological and behavioural manifestations of sensory modulation dysfunction. In order to modulate sensation for adaptive behaviour, there must be an appropriate balance between habituation and sensitization. Habituation occurs when the central nervous system recognizes stimuli as familiar and therefore no longer responds to them. Sensitization is the process in which the central nervous system recognizes stimuli as harmful or important and therefore heightens the response. Individuals with sensory defensiveness have low thresholds for sensory stimuli, typically leading to heightened responses with less habituation. This, in turn, may lead to behaviours associated with sensory sensitivity such as fearfulness, cautiousness, or sensory avoiding.

Sensory defensiveness often has a social–emotional impact as well. For example, Knickerbocker (1980) discussed clustered clinical patterns among sensory systems. Her descriptions identified avoidance patterns and emotional issues in sensory hypersensitive and hyposensitive children as outlined below:

Primary avoidance patterns are patterns of behavior directly related to a hyper- or hyposensitive response. A secondary avoidance pattern refers to behavior in motor output, social interaction, or academic performance which is disorganized or interfered with because of the child's sensory defensiveness or dormant response. A tertiary avoidance refers to a more serious emotional disturbance that may be related in part or originate in large measure from the primary sensory defensiveness and/or dormancy.

(Knickerbocker, 1980: 34)

Kinnealey and colleagues (1995) also identified avoidance as a coping mechanism for adults with sensory defensiveness.

Oliver (1990) provided further descriptions of the social–emotional impact of sensory defensiveness in adults. Adults with sensory defensiveness described feeling anxious and uncomfortable in social situations and having to adapt or eliminate activities because of their responses to sensory stimuli in those environments or situations. For example, they would avoid wearing certain clothing and make-up or participating in social activities that most people would enjoy. The relationship 'between sensory defensiveness and more profound social–emotional problems has long been suspected by clinicians' (Kinnealey et al., 1995: 450). Preliminary research has also linked sensory defensiveness to more pervasive social–emotional problems such as anxiety.

Ayres was the first to link anxiety to sensory defensiveness when describing children with tactile defensiveness, 'Anxiety surrounds all tactile experiences that the child himself does not initiate' (Ayres, 1964: 89). A significant relationship has been found between the level of anxiety and sensory defensiveness in adults (Kinnealey and Fuiek, 1999). Anxiety is a state of uneasiness (Sykes, 1982) which can either promote or interfere with efficient functioning (Thomas, 1985). Beck and Emery (1985) described symptoms of anxiety as interfering with effective

functioning. They further categorized these into cognitive (i.e. difficulty with reasoning or concentration), affective (i.e. edgy, fearful, or uneasy), behavioural (i.e. avoidance, restlessness, or inhibition), or physiological (i.e. heightened reflexes, increased heart rate, or insomnia) symptoms (Beck and Emery, 1985).

Preliminary research on the effectiveness of sensory integration treatment with sensory defensive adults was described in a case study of an individual who experienced panic attacks. David (1990) identified factors related to sensory defensiveness in a case report. A 24-year-old female was admitted to an inpatient psychiatric unit for treatment of depression and panic attacks. An occupational therapy evaluation identified her as having decreased kinaesthesia (conscious and internal awareness of one's body), gravitational insecurity (abnormal distress reactions to vestibular sensory stimuli), and defensiveness to tactile, visual and auditory information. This resulted in learned patterns of avoidance behaviours to certain environments or situations, including emotional interactions, involving sensory stimuli which elicited defensiveness. This further influenced her relationships and interactions with others. The patient was provided with treatment through education regarding sensory normalization and instruction of a sensory diet. This included the use of tactile and proprioceptive activities to help regulate her state of arousal. As identified in clinical observations, self-report, and an increase in her Allen's cognitive levels, the treatment reportedly supported her ability to function independently while controlling her panic attacks without subsequent hospitalization.

Both sensory defensiveness and anxiety have the power to be very debilitating across all aspects of an individual's life including emotional and social experiences, motor performance, and activities of daily living (Wilbarger and Wilbarger, 1991; Beck and Emery, 1985; Pfeiffer, 2002). If sensory integration treatment could ameliorate the effects of sensory defensiveness and anxiety, it would assist individuals to function more effectively and could greatly improve productivity and quality of life. Although there is support for a relationship between sensory defensiveness and anxiety (Kinnealey and Fuiek, 1999), the authors could find no research that examines the effectiveness of treatment interventions for sensory defensiveness in adults nor the impact treatment has on anxiety associated with sensory defensiveness. The purpose of this study was to explore the relationship between sensory defensiveness and anxiety and to determine if treatment of sensory defensiveness reduces both sensory defensiveness and anxiety.

Methodology

Subjects

A convenience sample of 15 adult volunteers between the ages of 26 and 46 years participated in this study. Fourteen of the subjects were female and one was male. They were professionals who lived in the northeastern region of

the United States. Subject recruitment occurred through an article printed in *Penn Point*, a professional newsletter, targeted at occupational therapists treating individuals with sensory defensiveness. Fliers were also posted in private clinics and circulated to paediatric occupational therapists. Subjects were primarily self-referred for the study. Inclusion criteria was as follows: (1) volunteers between the ages of 20 and 60; (2) no history of sexual or physical abuse; (3) no clinically diagnosed psychopathology or medical condition; (4) normal intelligence; and (5) self-identified as having sensory defensiveness in one or more sensory systems. Subjects were screened with the Adult Sensory Questionnaire (ASQ; Kinnealey et al., 1995) to determine the presence of sensory defensiveness. Subjects who scored nine or more on the ASQ were interviewed using the Adult Sensory Interview (ADULT-SI). Those individuals deemed sensory defensive by interviewers were included in the study.

Design

This study is a quasi-experimental pilot study. Subjects were pre-tested and re-tested one month later after intervention. The subjects implemented a self-treatment programme for one month after which they were re-tested.

Instrumentation

Adult Sensory Questionnaire (ASQ): The ASQ is a 26-item true/false questionnaire developed to screen for sensory defensiveness in adults. It is a self-administered questionnaire which can be given to a group or an individual. When the ASQ was administered to 300 adults, the mean score was 6 and the standard deviation 4. Therefore, a person with a score of 10 or above is identified as sensory defensive (Kinnealey and Oliver, 2002). Out of the 300 subjects, 6% were male and 94% were female although there were no reported differences between these groups in scores. All of the subjects were between the ages of 18 and 48 (Kinnealey and Oliver, 2002).

Test-retest reliability for the ASQ was 0.917 when calculated on scores of 16 adult subjects who were tested and re-tested one week later. Another test-retest study was completed by the authors who looked at the changes in scores of 97 people before and after a three-day workshop on sensory defensiveness. It was suspected that education on sensory defensiveness would result in changes in the scores on the post-test ASQ. There was a significant difference at the $p = <0.05$ level between pre-test and post-test ASQ scores. The ASQ is intended for use as a screening tool to measure sensory defensiveness. The authors suggest that this tool be used in conjunction with information obtained from the ADULT-SI.

Adult Sensory Interview (ADULT-SI): The ADULT-SI was used to measure sensory defensiveness in adults (Kinnealey et al., 1995). It is an 82 item semi-structured, open-ended question format to elicit information regarding a person's

perception and responses to various sensory stimuli. It has a scoring range from 0 to 82 with each question receiving a score of 1 (defensive) or 0 (non-defensive). The ADULT-SI demonstrated strong inter-rater reliability in four different preliminary studies. There was a 100% concurrence among raters in identifying sensory defensive and non-sensory defensive individuals in all of the studies.

Beck Anxiety Inventory: The BAI (Beck et al., 1988) was used to measure the level of anxiety in subjects and is grounded in Beck and Emery's (1985) cognitive theory of anxiety. This theory identifies that an individual's vulnerability to anxiety begins with a cognitive response, which includes an assessment of a threat based on the environment, past experiences, and the individual's own belief about the ability to cope with the threat. Based on this cognitive information, a person will either mobilize to cope with the threat or feel helpless, leading to a higher level of anxiety. The BAI is a self-administered paper-and-pencil questionnaire and was designed to be completed in approximately 15 minutes by individuals between the ages of 17 and 80 years of age. The BAI consists of 21 items rated on a scale of 0 to 3. Each item is used to assess subjective, somatic or pain-related symptoms of anxiety. Interpretation of total scores is categorized as minimal, mild, moderate, or severe levels of anxiety. Caution was used in interpretation, as this tool was initially administered to adult psychiatric outpatients. Clinical reliability and validity was reported on 160 individuals diagnosed with panic disorder with and without agoraphobia, social phobia, obsessive-compulsive disorder, and generalized anxiety disorder (Beck et al., 1988). Beck and colleagues reported an internal consistency of $r = 0.92$. Test-retest reliability was $r = 0.75$ after one week. Concurrent validity with the Hamilton Rating Scale for Anxiety - Revised was $r = 0.51$.

Evaluators

The researchers and evaluators who administered the ADULT-SI and provided treatment intervention and education were occupational therapists with two or more years experience. They were all graduate occupational therapy students assisting with the study to complete their Master's thesis. All had training in sensory integration theory and treatment. They also participated in a one-day training session on the protocol of the study.

Procedure

When potential subjects responded to the announcement of the study and expressed interest in participating, they were contacted by telephone and the study time lines and procedures were described to them. The researchers explained verbally that the study was designed to measure sensory defensiveness as a distinct condition and that certain additional conditions would complicate the results. The researcher explained to the

potential participants that only those individuals without any history of mental illness, physical or sexual abuse, or those with medical conditions would be included in the study. If they did not meet the criteria or for any reason chose not to be in the study, they were asked to state this and that no explanations were necessary. This allowed individuals to decline without disclosing specific confidential information. At the initial testing session or upon receiving the initial testing package, the subjects signed consent forms for participation in the study and to allow audio taping of the ADULT-SI. The ASQ and the BAI were also completed. The results of the ASQ determined whether or not a person would be included in the study. The ADULT-SI was used to gather more information on the specific nature of their sensory defensiveness which was needed to guide treatment. The interview explored life patterns regarding sensory defensiveness and information on the coping mechanisms incorporated into the participants' lives. The interview was not only important in determining the presence of sensory defensiveness, but also it served as a mechanism to educate and provide insight to the subjects on what sensory defensiveness is and how it may influence their lives.

A treatment protocol was developed based on the model recommended by Kinnealey and colleagues (1995). It included the following three components: (1) patient insight into sensory defensiveness, (2) regular and daily sensory input, and (3) engaging in physical activities of the patient's choice which provided tactile, vestibular and proprioceptive input. The ADULT-SI provided insight to guide further assessment and to organize the intervention session. Following the interview, intervention and self-treatment techniques were explored. Participants tried pieces of clinical equipment to determine their positive or negative impact in order to design individual 'sensory diets'. A sensory diet consists of activities providing regulated sensory input to the nervous system that can be incorporated into a person's daily routine. The equipment included a Morfam vibrator (a large muscle vibrator), an air pillow, a surgical scrub brush, a floor mat, a platform swing, a rocking chair, a therapy ball, and, finally, a small trampoline. All activities had elements of deep pressure tactile, proprioceptive, and vestibular input. The equipment and the type of sensory input provided is listed in Table 1.

The participants then described how each piece of equipment made them feel and ranked it from 1 to 10 with 1 being negative and 10 being very positive. The subjects were also interviewed about activities they liked to participate in that provided tactile, vestibular and proprioceptive input. From all of this information, a sensory diet was then designed individually for each subject to be carried out for the next four weeks. Participants kept a log of their daily activities and reactions and were provided with possible formats on how to organize this log.

The participants were contacted on a weekly basis by phone, and interviewed using the following questions:

TABLE 1: Equipment and its sensory properties	
Equipment	Sensory properties
Therapy ball	Proprioception and vestibular
Rocking chair	Vestibular
Brush	Deep pressure touch
Air pillow	Ventral deep pressure touch and vestibular
Trampoline	Proprioception and vestibular
Platform swing	Vestibular
Morfam vibrator	Deep pressure touch and vibration
Floor mat	Deep pressure touch

1. Are you doing the treatment?
2. Are there any problems or changes needed in the treatment?
3. How are you responding or feeling?
4. Do you have any questions?

During these times, adjustments to the protocol were made if needed.

At the end of the four weeks of self-treatment, subjects completed the BAI and also another ADULT-SI. The participants were asked their impressions of the treatment, whether or not it had helped them and if it had in what way.

The study occurred in a variety of settings including the homes of certain subjects or in a small private occupational therapy clinic.

Data analysis

The data was analysed using t-tests to determine if there were differences between pre- and post-test group scores on the BAI and ADULT-SI from pre-test to post-test. Correlations were calculated to determine if there was a relationship between defensiveness and anxiety.

Results

Question one explored the relationship between sensory defensiveness and anxiety. To determine if there was a relationship, a Spearman Rho correlation coefficient was calculated between the ADULT-SI scores pre-test and the BAI scores pre-test. The results confirmed a positive relationship between sensory defensiveness and anxiety ($r = 0.61$, $p = 0.027$). This further supports the previous findings of Kinnealey and Fuiiek (1999) which identified that individuals who experience sensory defensiveness have higher levels of anxiety.

Question two asked if there was a difference in ADULT-SI scores following self-treatment by adults with sensory defensiveness. A Wilcoxon matched-pairs signed-ranks test was used to compare the pre- and post-test mean scores for the

Test	Mean	SD	t	p
ADULT-SI				
Pre-test	37.53	12.22	2.17	0.048
Post-test	33.00	9.47		
BAI				
Pre-test	10.93	10.75	2.20	0.0453
Post-test	6.93	6.51		

ADULT-SI. There was a significant difference in pre-test and post-test mean scores ($p = 0.048$) (see Table 2).

Question three asked whether there was a reduction of anxiety as a result of self-treatment of sensory defensiveness. T-tests were completed to determine if levels of anxiety changed following self-treatment as measured through the BAI. There was a significant difference ($p = 0.0453$) between the pre-test and post-test on the BAI (see Table 2).

Results indicated that the mean anxiety level was reduced from moderate/mild to minimal on the BAI classification following treatment of sensory defensiveness.

Discussion

The results supported the hypothesis that there is a significant relationship between sensory defensiveness and anxiety. This further supports clinical observations by Ayres (1964) and results of other studies (Kinnealey and Fuiiek, 1999; Oliver 1990). Kinnealey and Fuiiek (1999) included 32 normal functioning adults in their study who were identified as either sensory defensive or non-sensory defensive based on the ADULT-SI. Those identified with sensory defensiveness demonstrated significantly higher levels of anxiety. Others have identified the social-emotional costs of sensory defensiveness (Kinnealey et al., 1995; Pfeiffer, 2002). Kinnealey and colleagues described the experiences of living with sensory defensiveness in five adults and the impact on their lives. They found that in addition to the perceived unpleasantness of the sensory experiences, the coping mechanism used took a toll on their lives in terms of time, effort and thought as well as affecting their choice of social activities. Pfeiffer (2002) conducted a case study identifying the impact of sensory integration dysfunction including sensory defensiveness on occupational participation and choice and social-emotional well-being of an adult. Pfeiffer (2002) found that the presence of sensory integration dysfunction limited the choices of occupations for the individual and lead to an avoidance of those occupations that were not individual in nature.

The relationship between anxiety disorders and sensory defensiveness may

extend beyond observable social–emotional behaviours. Anxiety is a complex process but most specifically relates to the threat-response apparatus of the brain, primarily the reticular formation. Sallee and March (2001), in a literature review, identified research evidence supporting the reticular formation's involvement in controlling arousal and attention levels related to the emotional distress associated with anxiety disorders. They further found that the functions of the limbic system, amygdala and hippocampus affect the emotional-processing circuits. It was also hypothesized that sensory defensiveness is associated with reticular activation and limbic system dysfunction (Lane, 2002). Further research into the similarities between the neurological processes of anxiety and sensory defensiveness may provide insight into their relationship.

Results also identified significant changes in both sensory defensiveness, as measured by the ADULT-SI, and anxiety, as measured by the BAI, from pre-test to post-test. Sensory defensiveness and anxiety decreased after self-treatment for sensory defensiveness. This provides support for intervention to decrease both sensory defensiveness and secondary social–emotional impacts such as anxiety.

This study was limited by the small sample size and lack of a control group. It is essential to continue research with larger sample sizes, random assignment and with a control group in order to make generalizations to a larger population. In particular, a study focusing on anxiety and depression in individuals with sensory defensiveness who have a self-treating lifestyle versus those who do not would further identify effective interventions integrated into daily routines and functional occupations. Those people with a self-treating lifestyle engage in activities either daily or several times a week that provide them with proprioceptive, vestibular and/or tactile stimulation.

This research focused on adults with no psychiatric diagnoses. It is highly recommended that future research includes adults who have clinical anxiety, depression, and defensiveness, since a number of subjects were not included in this study because they had a psychiatric diagnosis. A study exploring the effectiveness of treatment for sensory defensiveness in those individuals diagnosed with anxiety disorders is most relevant. Studies could also expand assessment measurements to include physiological measurements such as electrodermal responses (McIntosh et al., 1999) to determine whether or not physiological responses are affected by sensory integrative interventions.

In summary, this study provided additional support for the relationship between anxiety and sensory defensiveness as well as support for the effectiveness of self-treatment interventions to decrease sensory defensiveness and secondary anxiety. As it is a pilot study, further studies are necessary to determine the effectiveness of treatment for sensory defensiveness on behaviours associated with both anxiety and sensory defensiveness.

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