

A Study on Evaluation of Before and After Wearing the Deep Touch Pressure Therapy Compression Garment by Children with Autism

Dr. Amrita Roy¹, Dr. Himadri Ghosh², Dr. Isha Bhatt³

¹Associate Professor, Knitwear Design Department, National Institute of Fashion Technology, Hauz Khas, New Delhi -110016 (India)

²Former Professor, Former Dean & Director, Department of Design, Banasthali Vidyapith, Vanasthali - 304022, Rajasthan (India)

³Assistant Professor, Faculty of Design, Banasthali Vidyapith, Vanasthali - 304022, Rajasthan (India)

Abstract

Autism is a neurodevelopmental disorder characterised by severe difficulties in communication and social interaction as well as a restricted pattern of repetitive and stereotyped behaviour.

Due to its extensive range of symptoms, including issues with communication and social interaction, repetitive behaviours, and sensory processing disorder, it is known as autism spectrum disorder (ASD).

Children with ASD experience anxiety which leads to outbursts and eventual meltdowns. Autism interventions typically involve Deep Touch Pressure (DTP) Therapy. Occupational therapists frequently apply deep pressure to patients with autism spectrum disorders. For children with autism, occupational therapists employ a variety of devices to provide deep contact pressure, including weighted vests, compression vests, pneumatic pressure garments, and weighted blankets etc. Research examining deep pressure is scarce. Additionally, a number of studies have shown the efficacy of DTP. A therapy compression garment for autistic children with sensory defensiveness was developed using a user-centric design paradigm. The aim of this study was to evaluate the before and after wearing the deep touch pressure therapy compression garment worn by the six wearer children with Autism.

Keywords: Autism, Anxiety, Clothing, Children, Deep touch pressure, Therapy garment

1. Introduction

The term "Autism Spectrum Disorder" (ASD) refers to a group of neurodevelopmental disorders that includes Asperger's syndrome, Autistic disorder, and other pervasive developmental abnormalities (PDD-NOS) (Johnson & Myers, 2007).

Children with ASD struggle with social interaction, communication, and stereotypic behaviour. In addition, they follow particular patterns and have limited interests. Although though each child is different, there are a few defining signs that are present in nearly all children who have been diagnosed with ASD. These factors include trouble interacting and communicating, which may involve avoiding eye contact in order to avoid attention, misconception of language, and having limited or specific interests, such as a particular style of playing with toys / any objects etc (Martínez-Pedraza & Carter, 2009).

Deep touch pressure (DTP) is a type of tactile sensory input that is often facilitated by physical actions including holding, stroking, hugging, compressing, wrapping, and squeezing. It is well recognised that the therapies connected to DTP intervention help people's physical and emotional health (Zissermann, 1992).

Occupational therapists (OT) working with children with Autism Spectrum Disorders (ASD) frequently use DTP because it is believed to be more effective in reducing symptoms of anxiety, panic attacks, and stress as well as for better behaviour management, increased focus during daily activities, and academic progress. Since that DPT is non-invasive, simple to use, and without any known adverse effects, it is thought to be a significant and beneficial practice (Case-Smith, Weaver, and Fristad, 2015).

Research in this area has shown that DTP interventions and therapies can improve quality of life and personal satisfaction in individuals who experience high levels of stress, anxiety, and restlessness. It has also demonstrated success in helping individuals with autism spectrum disorder, attention deficit hyperactivity disorder, developmental disabilities, and other special needs (Edelson, Edelson, Kerr, & Grandin, 1998).

Several products have been developed based on DTP therapy, most of which are wearable and include products such as weighted vests and blankets, inflatable vests, and tight-fitting compression garments.

Temple Grandin is a world-renowned researcher and autistic person herself has developed a deep touch pressure device, a "squeeze machine", that can be controlled by the individual to reduce anxiety due to ASD (Grandin, T. 1992).

The Active "hugging" vest provides a hug-like sense of comfort through heat-activated shape memory alloy (SMA) springs, that can contract on command to calm children with anxiety, and enhance their adaptability and concentration. (Duvall, J. C., Dunne, L. E., Schleif, N., & Holschuh, B., 2016).

Deep pressure has a considerable favourable effect on majority of individual with autism with varying individual responses, it has been linked to improved wellbeing in people with ASD and aids in processing sensory input, according to numerous studies. The results suggest that deep touch pressure therapy should be designed and delivered in a certain way depending on the requirements of the individual. (Bestbier & Williams 2017)

To summarise, although several studies have been done to look at the implications of DTP techniques, theoretical understanding of DTP therapies is inadequate, and studies have shown a range of outcomes (Losinski, Cook, Hirsch, & Sanders, 2017). Although DTP has been administered for a while, there isn't much evidence to support its application to challenging behaviour in ASD patients. New DTP enabled devices have emerged recently and have proven to be quite beneficial for welfare of individuals with autism (McGinnis, Blakely, Harvey, Hodges, & Rickards, 2013).

2. Methods

2.1 Objective

To evaluate the effects of before and after wearing the deep touch pressure therapy compression garment on the children with autism.

2.2 Research Design

Visual analogue scales (VAS) were used to measure activity and mood of the six children with autism before and after wearing the deep touch pressure therapy compression garment.

The effects of deep pressure sessions on children with ASD were assessed using a pre-test - post-test approach.

2.3 Participants

The study was conducted in special schools and occupational therapy centers for autistic children. Eight children, one girl and seven boys, were chosen to participate in the study based on their behaviors that occupational therapists and special educators thought suggested that they need deep pressure, behavioral signal such as head-banging, straining to squeeze into very small spaces, and stamping their feet were displayed by the children. The children's ages varied from 4 to 12 years. Table 1 provides further information on the young individuals who participated in the study and the study outcomes were assessed every day for six weeks. One participant completed only five days before and after compressions.

Eight children with autism spectrum disorder and tactile defensiveness were recruited for the current study, in order to assess the effects of deep touch pressure therapy compression garment.

The study excludes two participants (both boys) who discontinued the research due to personal reasons and their data were not used in the analysis.

Table 1. Characteristics of the study sample (n = 6)

Participant's Code	Gender	Age
S	Female	4.5 years
A	Male	5 years
R	Male	6 years
T	Male	7 years
D	Male	12 years
N	Male	8 years

The study sample included 6 participants with only one female. The age of the participants ranged from 4 to 12 years.

2.4 Measures

Visual analogue scales (VAS) were used to measure activity and mood of the children. The VAS is a 10 cm lines with the extremes representing "not at all" and "very". Five areas of mood and behaviour were rated using the VAS: calmness, engagement with activities, responsiveness to instructions or other stimuli in the environment, happiness, and communicativeness. The children parent / special educator / Occupational therapist were given a Visual analogue scale (VAS) which was used to measure activity and mood of the children for both before and after wearing the Compression garment. It was assessed daily for six weeks.

2.5 Procedure

The compression garment were worn by the six children recruited for the study, and they were observed every day for six weeks. Each child was observed for 45 minutes for both before wearing as well as after wearing the compression garment, for occupational therapy sessions.

2.6 Analysis

Single case research (SCR) was used in the current analysis. Data was presented and analysed for each of the six children included in the analysis. Statistical analysis was performed using the Tau-U statistic with baseline correction for trend (Parker et al., 2011). Tau-U measures the difference in data range (non-overlap) between two phases (A and B), while being able to correct for a moving baseline. The two phases included in the analysis were before and after deep pressure. A Radar plot was used to visualize the mean change in five rating scales, Statistical analysis was performed using R v 3.5.2, Microsoft excel (radar plot) and the online Tau U calculator that can be used for single case research (SCR). For each domain, the contrasts (comparisons within participants) were combined into a weighted average to get an aggregated effect size. The weighted average represents the overall change in each domain aggregated across all participants. Weights were applied to take into account the different number of sessions across participants. Hypothesis testing was performed to assess whether the overall effect size (weighed average) was significantly different from zero.

3. Results

Table 2 summarizes the results (mean ± SD) for each of the five scales before and after the intervention (deep pressure sessions for each participant). The Z-statistic for the Tau U test along with its statistical significance is also shown for each domain. The means were lower post-intervention compared to pre-intervention across all scales and for all participants. Single case research analysis (using the Tau U test) showed that the change was statistically significant at the 0.001 level (the probability of observing such change by chance only is less than 0.1%). This means that there is enough evidence to support the beneficial role of the intervention in decreasing the VAS across the five domains tested.

Table 2. Means and standard deviations recorded for the scales before and after deep pressure sessions.

Participant (number of sessions)	Gender	Before session Mean (SD)	After session Mean (SD)	Z value of Tau-U statistic
S (42)	Communicative	5.81 (1.18)	1.25 (0.53)	-7.798***
	Calmness	6.04 (0.75)	0.88 (0.44)	-7.8904***
	Responsivity	5.75 (0.67)	1.01 (0.61)	-7.8904***
	Happy	5.20 (0.99)	1.06 (0.57)	-7.8904***
	Engaged	5.73 (0.94)	1.05 (0.67)	-7.8904***
A (42)	Communicative	6.08 (0.51)	1.45 (0.97)	-7.8904***

	Calmness	5.86 (0.62)	1.15 (1.14)	-7.8904***
	Responsivity	5.38 (0.96)	0.83 (0.58)	-7.8904***
	Happy	5.65 (1.07)	1.07 (0.41)	-7.8904***
	Engaged	5.94 (0.40)	0.86 (0.65)	-7.8904***
	Communicative	6.58 (0.65)	0.81 (0.59)	-7.8904***
	Calmness	5.29 (0.86)	1.02 (0.56)	-7.8904***
R (42)	Responsivity	5.83 (0.73)	1.10 (0.53)	-7.8904***
	Happy	5.74 (0.70)	0.93 (0.56)	-7.8904***
	Engaged	5.10 (1.14)	1.00 (0.54)	-7.8904***
	Communicative	4.97 (0.82)	3.31 (0.66)	-5.6062***
	Calmness	5.90 (0.72)	4.24 (0.79)	-5.5907***
T (30)	Responsivity	5.41 (0.50)	3.97 (1.45)	-3.639***
	Happy	3.76 (1.02)	2.55 (0.99)	-3.8256***
	Engaged	6.14 (0.44)	4.07 (1.13)	-6.4305***
	Communicative	3.81 (1.25)	1.71 (1.35)	-5.7389***
	Calmness	3.90 (1.79)	1.21 (1.18)	-5.8597***
D (42)	Responsivity	3.71 (1.73)	1.33 (1.16)	-5.5913***
	Happy	3.64 (2.07)	0.33 (0.90)	-6.0654***
	Engaged	3.88 (1.45)	1.29 (0.83)	-6.9064***
	Communicative	3.93 (1.60)	0.98 (0.95)	-7.0137***
	Calmness	6.44 (1.20)	0.83 (0.82)	-7.8904***
N (42)	Responsivity	8.24 (1.61)	1.63 (0.72)	-7.8904***
	Happy	6.14 (1.99)	0.99 (0.95)	-7.6623***
	Engaged	5.02 (2.76)	1.10 (0.93)	-6.1325***

* P value for the Z statistic < 0.05

*** P value for the Z statistic < 0.001

In Figure 1 the plot shows the mean change in the 5 domains for each participant with 0 at the centre of the plot. A positive score indicates improvement (decrease) in the mean score. Results showed a consistent improvement across all participants with participants D and T showing the least improvement. Participant N showed the best improvement responsivity while participant R showed the best improvement in the communication domain.

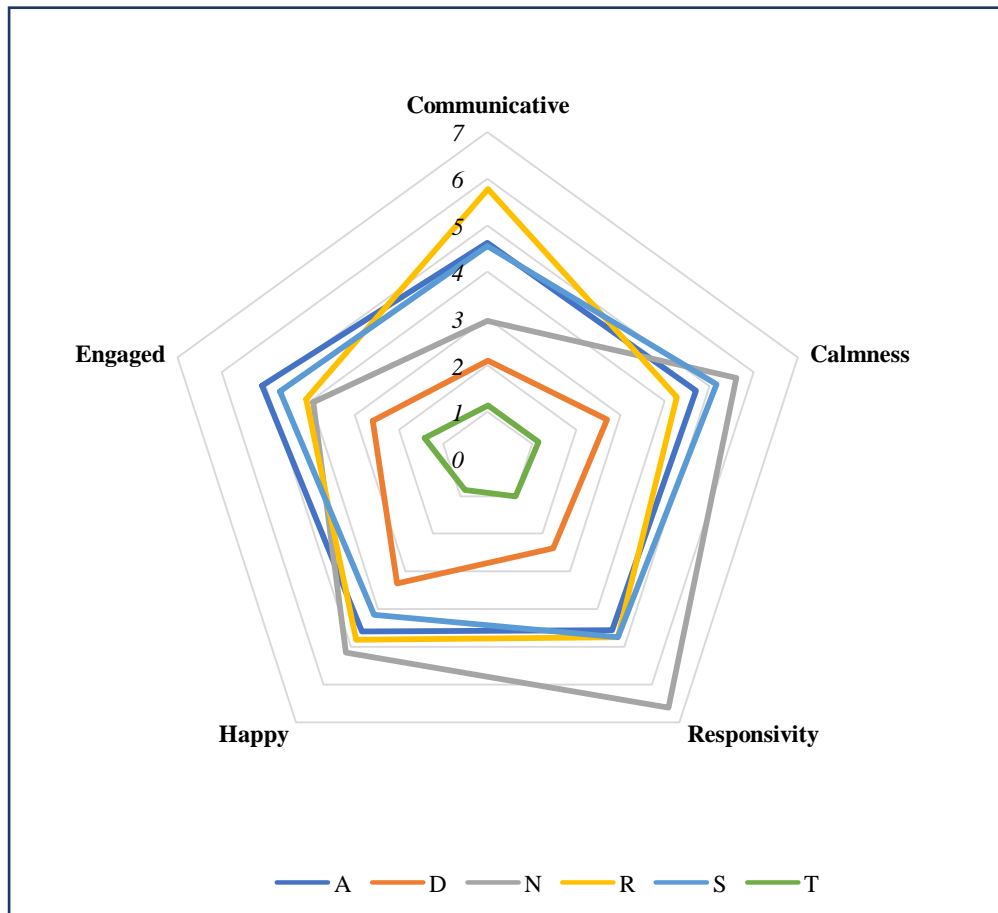


Figure 1. Radar plot for the mean change across the five domains (stratified by participant)

To obtain an aggregated effect size for each domain, the contrasts (within-participant comparisons) were combined together into a weighted average. The overall change in each domain as a whole, as accumulated across all individuals, is represented by the weighted average (Table 3). To account for the varying number of sessions across individuals, weights were applied. Hypothesis testing was performed to assess whether the overall effect size (weighed average) was significantly different from zero.

Table3. Aggregated effect size for each domain (weighed average)

Domain	Weighed change	Tau	Z	P value
Communicative	3.66	-0.9139	-17.0277	< 0.001
Calm	4.08	-0.9352	-17.4255	< 0.001
Responsiveness	4.17	-0.887	-16.526	< 0.001
Happy	3.97	0.8964	-16.7014	< 0.001
Engaged	3.75	-0.938	-17.4776	< 0.001

Results were statistically significant for all domains ($P < 0.001$) which indicates that the aggregated weighed change in VAS was significantly different from zero for all domains i.e. the intervention was successful in reducing the VAS across all domains (Figure 2). The highest change was observed in the responsiveness and calmness domains while the lowest change was observed in the engagement domain(Figure 2).

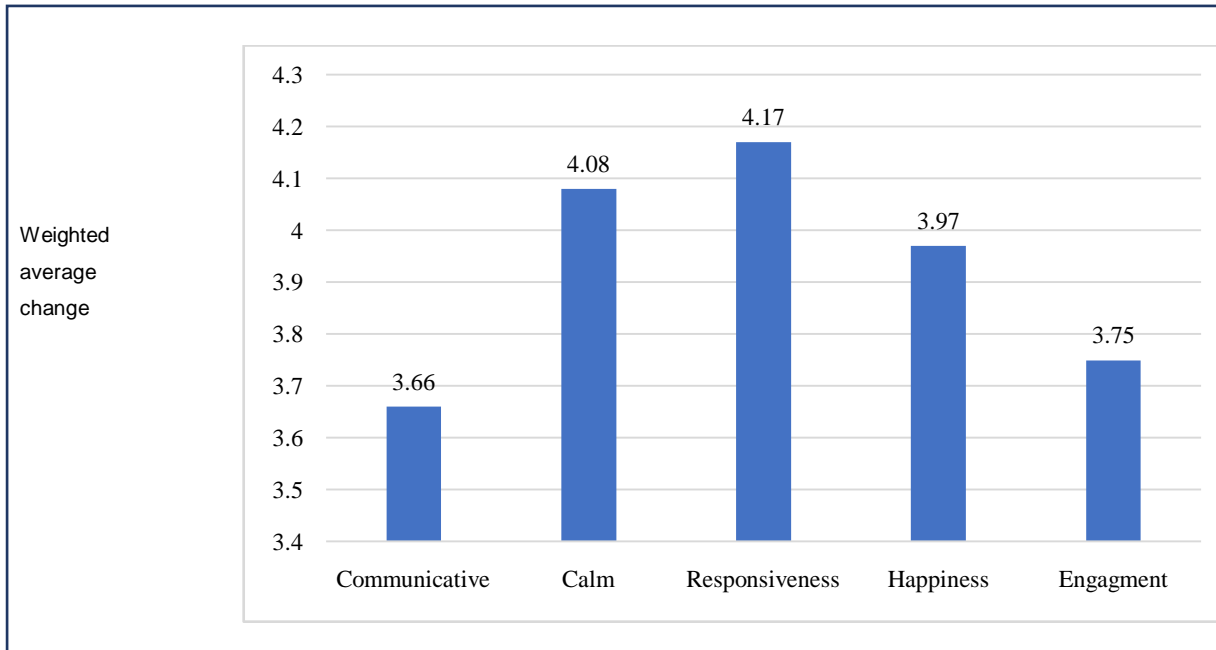


Figure 2. Weighted average change in the VAS across the five domains

4. Conclusion

Most of the children in this study have benefited from wearing the Deep Pressure Therapy garment.

According to the results, all the participants A, D, N, R, S, and T have shown consistent improvement in their mood and behaviour, in all the domains such as communication, calmness, responsiveness, happiness and engagement, with participants D and T demonstrating the least improvement. While participant R demonstrated the best improvement in the communication domain, participant N demonstrated the best improvement in responsiveness domain.

Wearing the seamless knitted compression garments by the children with autism , their sensitivity issues have stabilised,and their concentration on activities have improved. It has been observed that there has been an constant improvement in calmness aspect, involvement in activities, response to cues or other environmental stimuli, happiness, and communicativeness across all participants. Also, it was noted that the responsiveness and calmness domains showed the most change, whereas the engagement domain showed the least change.

To conclude, this study has shown that wearing the seamless knitted compression garment and applying deep pressure through the therapy clothing appears to have the great positive effects such as reduction in anxiety and stress on thechildren with autism.

Moreover, not all participants experience the benefits to the same degree, indicating the need for additional research to identify the populations most likely to benefit.

Limitation

This study uses rating scales to provide an open – label evaluation.

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