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The effects of traditional Thai massage delivered by parents on stereotypical behaviors in children with autism: a pilot studyChanada Aonsri¹, Nutthanun Tatchananusorn², Paradee Auvichayapat³ and Wichai Eungpinichpong^{4,*}¹Khon Kaen University Demonstration School, Special Education (Autistic Research Centre), Faculty of Education, Khon Kaen University, Khon Kaen, Thailand²Physical Therapy Clinic, AMS Wellness Center, Faculty of Associated Medical Sciences, Khon Kaen University, Khon Kaen, Thailand³Department of Physiology, Faculty of Medicine, Khon Kaen University, Khon Kaen, Thailand⁴School of Physical Therapy, Faculty of Associated Medical Sciences, Khon Kaen University, Khon Kaen, Thailand*Corresponding author: wiceun@kku.ac.th

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Abstract

Stereotypical behavior is one of the learning and social skills development problems that affect children with autism. Previous studies found that traditional Thai massage (TTM) could reduce stereotypical behaviors in autistic children. However, the effects of TTM delivered by the parents of autistic children have not been explored. This pilot study investigated the effects of TTM by parents on stereotypical behaviors in children with autism. A one-group pretest-posttest design was applied for 15 children, aged 4-16 years, with their parents' permissions. They participated in the study at the Special Education program of the Special Education Center of Khon Kaen University, Thailand. After being trained in a specialized TTM for children, the parents delivered 50-min TTM to children once a day, twice a week for eight weeks. The severity of autism and autistic behaviors were measured using Childhood Autism Rating Scale (CARS), and Autism Treatment Evaluation Checklist (ATEC), respectively. The functions of autonomic nervous systems were measured using Heart Rate Variability (HRV) to indicated physical and mental disorders such as stress. The data at baseline and the 8th week were analyzed using either an independent t-test or Wilcoxon signed-rank test. The study found that 16 sessions of TTM significantly improved measured data for autism in all children including the CARS ($p < 0.001$), ATEC, speech/language/communication ($p < 0.001$), sociability ($p < 0.001$), sensory/cognitive awareness ($p < 0.001$), health/physical/behavior ($p < 0.001$), and HRV ($p < 0.001$). The results indicated that TTM performed by parents could be useful as an adjunct therapy for autistic children as it can reduce stereotypical behaviors and stress.

Keywords: Traditional Thai massage, Stereotypical behaviors, Autistic children, Parent

1. Introduction

Autism Spectrum Disorder (ASD) is a collection of neurodevelopmental illnesses that has been identified in the Diagnostic and Statistical Manual of Mental Disorders (DSM-V). It is characterized by deficits in social interactions, communication (both verbal and nonverbal), and the presence of repetitive and stereotypical behaviors [1]. In most cases, the symptoms of ASD start to appear in the first few years after birth, usually before the age of three [1]. There has been a higher incidence of ASD observed among young people in multiple countries [2]. In Thailand, 4.4 out of 1,000 Thai children aged below 12 years are autistic. The rate of occurrence for this condition has been recorded as 9.9 children out of every 10,000 individuals in the population [3]. Children diagnosed with ASD often experience challenges related to engaging in repetitive and rigid behaviors, also known as stereotypical behaviors. These may involve a fixed adherence to routines, repeating words or phrases, and repeating physical actions such as hand flapping, body rocking, or circular movements [4]. Stereotypical behaviors are caused by a neurochemical defect that leads children to engage in repetitive movements. Children with autism

are sensitive to stimuli. Unpredictable and excessive self-stimulation causes stress and anxiety in such children. Elevated stress results in more behavioral manifestations of stimulated physiological burden that induces repetitive behavior [5]. There are ways to reduce repetitive behavior in autistic children such as pharmacological use, behavior modification, or psychological counseling by a therapist. However, these are methods require skilled personnel which is costly and the children have to wait in long queues for treatment. This may lead to insufficient frequency of treatment [6]. In a study on the treatment of autistic children, behavioral therapy combined with non-pharmacological treatments was advised. Massage was also suggested as a complementary therapy to treat children with autism to reduce repetitive behavior [7].

Traditional Thai massage (TTM) is a specific massage technique that includes deep tissue massage, followed by passive stretching [8]. Recently, it has become a popular therapy for Thai people who need relaxation and recovery from fatigue after long-hours of work. Some studies suggested that Thai massage may improved the body's flexibility and range of motion, decreases pain, promote relaxation, and reduce anxiety [9-11]. This may be applied to children with autism since stereotypical movement is associated with stress and anxiety. TTM may be appropriate for these children since it can reduce stress and anxiety. TTM was found to raise sleep quality, reduce stereotypical behavior of children with autism and lower anxiety of their parents [6]. Furthermore, massage performed by parents can significantly improve sleep and control behavior in preschool-age children with autism by calming and relaxing them. Consequently, these children may concentrate on educational tasks [12-13]. Practically, parents of such children are encouraged by therapists in autistic care centers to become involved in therapeutic sessions for their children. The parents could be trained to have TTM skills and deliver it to their children. However, there is no evidence of the effects of TTM administered by parents on stereotypical behaviors in children with autism. Thus, this pilot study aimed to examine the effects of TTM delivered by parents on stereotypical behaviors in children with ASD.

2. Materials and methods

2.1 Study design and participants

This study involved purposive sampling employing a one-group pretest-posttest design. Autistic children with ages ranging between 4 to 16 years, were recruited from the the Special Education program of the Special Education Center (Autistic Research Centre), Khon Kaen, Thailand. Inclusion criteria consisted of children with stereotypical behavior diagnosed using the Diagnostic and Statistical Manual of Mental Disorders (DSM-V), communicating, and following at least 1 step of the measurement procedures. This process was tested by a psychiatrist or pediatrician. Furthermore, parents who had cared for a child at least one year, must understand and be able to communicate in Thai were included. They also had willingness to participate and cooperate in research studies. Children who had any other neurological diseases diagnosed by a physician were excluded. Moreover, children who received any other non-medical treatments were excluded from this study.

2.2 Procedure

Data were collected from June to December 2020. Fifteen autistic children with stereotypical behavior and their parents, who met the above inclusion criteria without meeting any exclusion criteria, participated in the study.

Before treatment, parents were invited to an informational meeting about participation in the research. They signed informed consent forms at the Autistic Research Centre. All the parents attended three training sessions (9 hours total) on theory and basic techniques of TTM for relaxation led by an expert in TTM. First, the parents learned the theory of TTM including definitions, basic principles, meridian lines, physiological effects, indications and contraindications of TTM. Then, the TTM expert demonstrated TTM techniques for children with autism. These techniques include hand placement, gentle touch and pressure massage along the meridian lines throughout the whole body, followed by gentle stretching of the major muscles of the limbs and back. After that, the parents practiced the TTM techniques. In the second session, the parents practiced the TTM techniques again, under supervision of an expert, until they understood and were able to correctly perform them. Finally in the third session, the parents were tested and certified by a TTM expert. Then, the researcher interviewed parents and their children before collecting data using the Autism Treatment Evaluation Checklist (ATEC). Afterward, the doctor tested the children to determine the severity of autism symptoms using a the Childhood Autism Rating Scale (CARS) before collecting data. Last, the physical therapist assessed the physiological stress of children by measuring Heart Rate Variability (HRV). The measurements required approximately 50 min. TTM sessions were held at the Autistic Research Centre, Khon Kaen, Thailand. There were 16 sessions done by parents and their children, each lasting around 50 min, two times a week, for eight consecutive weeks. The researchers recorded data from the children before and after the 16 TTM sessions (pre-test and post-test).

2.3 Intervention

After the parents receiving extensive TTM training with their children, they were assigned to deliver TTM to their children for 50 min a day, twice a week for eight weeks. The first step was to establish rapport before a TTM session. This was to produce cooperation and willingness of autistic children by reducing anxiety and fear. Room atmosphere, room organization, and temperature were carefully controlled between TTM sessions to make children feel relaxed. A 50-min whole body TTM sessions were used as an intervention in this study. Figure 1 shows a parent gently applying thumb pressure along the meridian lines in the neck, back, lower and upper extremities, and feet. At each of the meridian points, thumb pressure was applied for 5-10 sec, then repeated three times. The parents adjusted the thumb pressure so that it did not cause the children pain greater than their pain threshold. After the TTM sessions, the parents applied gentle stretches to the muscles, including calf, hamstring, and quadriceps, as shown in Figure 1.



Figure 1 TTM sessions for children. TTM lines of (A) the neck area, (B) the back area, (C) lower extremities (medial side), (D) the lower extremities (lateral side), (E) the lower extremities (anterior side), (F) the lower extremities (posterior side), (G) the upper extremities (anterior side), (H) the plantar surface of the foot. Stretching was also done for the (I) calf muscles, (J) hamstring muscles and (K) quadriceps muscles.

3.4 Measures

3.4.1 CARS

The CARS test is used to assess the severity of symptoms of ASD in children. It is a clinician-rated questionnaire with a 4-point rating scale based on observation of the participants and parallel information, such as parent and teacher reports. The researchers used this questionnaire to interview the parents while a single physician observed the child's behavior at the Autistic Research Center. CARS comprises 15 items covering various functions, including emotional, communicative, social, adaptive, and cognitive factors. It consists of minimal-to-no symptoms (15-29.5 for ages up to 13 years; 15 to 27.5 for ages older than 13 years), mild-to-moderate symptoms of ASD (30-36.5 for ages up to 13 years; 28-34.5 for ages older than 13 years), and severe symptoms of ASD (37 and higher for ages up to 13 years; 35 and higher for ages older than 13 years) [14].

2.4.2 ATEC

The Autism Research Institute created ATEC as a questionnaire to assess the efficacy of therapy for autistic patients [15]. The ATEC is suitable for autistic children aged two years and older. The questionnaire consists of 4 subscales that include speech/language/communication, sociability (Soc), sensory/cognitive perception and health/body/behaviour. A total score (from 0-180) can be calculated from the results of the four subscales. A higher score indicates more severe of autistic symptoms. ATEC was created to enable researchers to evaluate the therapies applied to ASD patients [16]. The ATEC's validity ranges from moderate to high. Children with mild ASD symptoms were discerned from other children using a cut-off score of 38 points. The difference between children with ASD and those without significant symptoms was defined as 68 points as a cut-off. Inter-rater reliability was very high (ICC = 0.97) [17]. In the current study, ATEC scores were estimated by a physical therapist for all children before and after TTM by an individual therapist.

2.4.3 HRV

Physiological stress was assessed using HRV measure. This tool was indirectly used to assess the autonomic nervous system from a recorded pulse rate and analyze variation in heart rate with time. Usually, HRV is influenced by the alternating functions of the sympathetic and parasympathetic nervous systems. A low HRV indicates physical or mental disorders such as stress, fatigue, and psychological disorders due to the influence of the sympathetic nervous system.

However, if HRV shows a high value the person is sleeping, resting, or relaxing from the influence of the parasympathetic nervous system. Muscular fatigue syndrome was associated with autonomic nervous system activation by stimulating the sympathetic nervous system, resulting in decreased HRV. Moreover, HRV also reflected physical performance assessed by the body working or during recovery of the function of cardiovascular and muscular system function. HRV variables that demonstrate how the parasympathetic nervous system is functioning are high-frequency power (HF), the standard deviation of all normal-to-normal intervals (SDNN), and the square root of the mean of the sum of the squares of differences between adjacent normal-to-normal intervals (RMSSD). HRV in this study was performed using a uBioMacpa (uBioClip v70 model manufactured by Biosense Creative Co., LTD, Korea) as a measurement device. A pulse detector is clipped onto the left hand index finger and its signal cable connected to a computer, which has a pre-installed HRV analysis program (uBioMacpa software) to record the pulse signal. The HRV and stress index results are automatically calculated. Before the measurements, the researchers screened volunteers' histories to ensure they were not drinking energy drinks or taking drugs that affect heart rate in the eight hours before prior to measurement. The participants were advised to avoid talking, physical movement, sleep, and breathing pattern adjustments during the measurements. [18-20]. HRV measurements were administered by a physical therapist.

3.5 Statistical analyses

Demographic data are presented as mean and standard deviation (SD) values. Normality of the data set was assessed using the Shapiro-Wilk test. Then, either a paired t-test (with normally distributed data) or Wilcoxon signed-rank test (with data not normally distributed) was used to compare the outcome variables before and after the intervention period within the group. A *p*-value of less than 0.05 was considered statistically significant. The results were analyzed with a standard statistical methodology using SPSS Version 17.

3. Results

Fifteen children with a stereotypical behavior condition and their parents who met the inclusion and did not meet the exclusion criteria were recruited. The mean (SD) age of children with autism was 6 years 5 months (1 year 6 months) and 80% were male. The parent's mean (SD) age was 41 years 5 months (1 year 7 months) in the group. Results also showed that after the 16 sessions of TTM intervention, the children had significantly improved in all measured factors (Table 1).

1. Autism symptoms and behaviors

After the intervention, a total of CARS score ($t = 20.00, p < 0.001$), the speech/language/communication (SCL) ($Z = -3.413, p < 0.001$), Soc ($t = 16.07, p < 0.001$), the sensory/cognitive awareness (SCA) ($t = 14.10, p < 0.001$), and the health/physical/behavior (HPB) ($t = 13.29, p < 0.001$) were significantly decreased. This indicates that the children's symptoms and behaviors were improved from the pre-test conditions (Table 1).

Table 1 Data comparison of CARS and ATEC before and after TTM intervention by parents in children with autism (N=15).

Paired samples test						
Dimension	Before massage	After massage	p-value		95% Confidence interval of the difference	
	Mean \pm SD	Mean \pm SD	p	t	Lower	Upper
CARS	42.53 \pm 5.20	26.40 \pm 5.34	< 0.001*	20.00	14.42	17.84
¹ Sco	22.66 \pm 6.11	5.06 \pm 2.98	< 0.001*	16.07	15.25	19.94
² SCA	19.33 \pm 5.35	6.80 \pm 4.72	< 0.001*	14.10	10.62	14.43
³ HPB	39.13 \pm 10.86	11.33 \pm 5.10	< 0.001*	13.29	23.31	32.28
Wilcoxon signed ranks test						
Dimensions	Median (Range)	Sum of rank	Wilcoxon probability		Wilcoxon value	
⁴ SCL	8.00	120.00	< 0.001*		-3.413	

*Statistical significance was defined as $p < 0.05$

3.2 HRV results

HRV results also indicated that after the TTM sessions, there was a significant decrease in the low-frequency power (LF) ($t = 31.15, p < 0.001$) and stress ($t = 14.88, p < 0.001$). However, the high-frequency power (HF) ($t = -72.95, p < 0.001$), the standard deviation of all normal-to-normal intervals (SDNN) ($t = -18.41, p < 0.001$), and the square root of the mean of the squares of differences between adjacent normal-to-normal intervals (RMSSD) ($t = -18.23, p < 0.001$) were significantly increased after the TTM sessions (Table 2).

Table 2 Data comparison of HRV before and after TTM intervention by parents in children with autism (N=15).

Paired samples test						
Dimension	Before massage	After massage	p-value		95% Confidence interval of the difference	
	Mean \pm SD	Mean \pm SD	p	t	Lower	Upper
LF	8.36 \pm 0.63	5.40 \pm 0.47	< 0.001*	31.15	2.75	3.63
HF	4.00 \pm 0.34	8.26 \pm 0.33	< 0.001*	-72.95	-4.38	-4.13
SDNN	48.20 \pm 6.67	91.98 \pm 13.17	< 0.001*	-18.41	-48.87	-38.68
RMSSD	18.29 \pm 1.94	61.72 \pm 10.45	< 0.001*	-18.23	-48.53	-38.31
Stress index	35.86 \pm 6.12	18.26 \pm 3.26	< 0.001*	14.88	15.06	20.13

*Statistical significance was defined as $p < 0.05$.

4. Discussion

This preliminary research investigated the effects of TTM performed by parents on stereotypical behavioral outcomes in autistic children. Fifteen parents and their children completed the TTM program. CARS data before and after the 16 sessions of TTM delivered by the parents revealed that stereotypical behaviors were considerably improved. These improved behaviors included social interactions, learning attention or cognition and reduced nodding or shaking arms, rocking motion of the hands, sudden running, body balancing forward and backward, repeated manipulation of objects, and finger movements. These results are consistent with a previous study indicating that foot massage decreased symptoms of attention deficit [7]. It appears that TTM had a clear impact

on reducing perceived muscle tension, which is a compelling factor in reducing symptoms of impulsivity and improving muscle relaxation. Another study conducted by Kangarlou et al. [10] showed that behavioral problems (hyperactivity and attention deficit) among children with attention-deficit/hyperactivity disorder (ADHD) in the intervention group might be reduced by educating parents [21]. Consequently, autism symptoms might be successfully reduced by intervention and caregiver engagement, whether through a partial care program or through control and management of behaviors. The findings of this study showed that TTM positively affected ADHD symptoms by decreasing anxiety in children with this disorder and enhancing social behavior, which consistent with Chen et al. [22] who reported that TTM positively reduced anxiety and symptoms related to stereotypical behavior.

Moreover, our study is supported by the results of Dane and Welcome, who found that foot reflexology reduced some behaviors, such as an unwillingness to cooperate with others, irresponsibility and unorganized memory, and lack of concentration [23]. Additionally, dealing with autistic children is stressful for caregivers. It distresses the caregiver and disrupt their relationship with their autistic child. Massage can promote mutual relaxation of children and their caregivers, thereby reducing their stress and improving their relationship [24].

ATEC was significantly improved in all aspects after TTM intervention, including the speech, language, communication, Soc, sensory/cognitive awareness, and health/physical/behavior aspects. These findings are confirmed a study in 1997 by Field et al. [13] who found that massage over four weeks improved autistic student conduct in the classroom using an autism behavior checklist and early social communication scales in twenty-two children. They found that autism behavior was significantly improved in a classroom setting, including orienting irrelevant sounds and stereotypical behavior, attention in school, social interactions, and behavioral requests in children. Furthermore, the results of improved autistic behavior might be an effective way for increasing social maturation and attachment between mother and autistic child through massage [25].

However, a study by Silva et al. in 2009 compared the effects of massage and a special education program in DSM-V autistic children. They found significantly improved sensory and behavior scores on a Sensory Profile and Daily Living Skills test in children with autism. Sensory impairment, social competence, and fundamental life capabilities of children were significantly improved [26]. Later, a study by Zhou et al. [27] discovered that speech therapy coupled with massage was useful for autistic children with communication difficulties. A previous study indicated that massage was beneficial for children with autism. It was better when caregivers who directly care for autistic children were trained in massage. The current study reports that TTM given by caregivers significantly reduced stereotypical behavior in children with autism. Additionally, data from a prior study demonstrated the advantages of massage in terms of a reduction in touch aversion and stereotypical behaviors, improved attention in classroom settings, more frequent family touching during playtime, with decreased excitement, crying, and self-stimulating behaviors that supports the relationship between autistic children and their caregivers [7]. Further research could be done to determine if TTM can improve children's communication skills and social interaction with their family and other people.

The raised HF, SDNN, and RMSSD scores after 16 weeks of TTM indicated a relaxation resulting from increased parasympathetic activities. A reduced LF and stress index also suggested that the children had less stress after TTM (Table 2). They also showed decreased sympathetic activities [28]. The result was in line with previous studies. Diego et al. [29] found that a moderate pressure massage on the whole-body induced relaxation responses with increased delta activity as well as decreased heart rate and beta activity. Butttagat et al. [10] found that a 30-min TTM session on the back muscles for patients with back pain improved heart rate variability and stress-related parameters. It also found that TTM decreased anxiety and increased parasympathetic nervous system activity.

Stereotypical behaviors are always provoked by raised stress in children with autism. TTM was found to reduce stress and these behaviors by inducing relaxation. According to our study, TTM intervention improved children's memory and attention deficiencies, collaboration with others, responsibility, and organization scores as well as the mean of the total score of the severity of autistic symptoms.

Moreover, massage therapy might increase oxytocin levels, which has beneficial effects on immunity. It has been linked to parameters associated with depression and anxiety as suggested by Morhenn et al. [30]. They investigated the result of massage on oxytocin levels in humans and found that it increased oxytocin and other hormones associated with human relaxation. Oxytocin was found to reduce LF of HRV, indicating that the body was resting or relaxing [28].

This pilot study has some limitations that need to be addressed. It had a small sample size and was a single-group study design without a control or comparison group. Thus, a definite efficacy of TTM delivered by parents for autistic children cannot be claimed due to the limitation of the single group study design. A further study with a randomized controlled trial and long-term follow-up is recommended. Additionally, this study did not calculate a minimum sample size due to its pilot study nature. Instead, our study data can be used for a sample size calculation in a future study. Also, complete sessions of TTM delivered by the parents or caregivers in this study may be in doubted. However, we trust that the caregivers performed TTM upon their children. Moreover, we regularly consulted caregivers by telephone. Finally, this study had no reliability test for CARS and HRV. Nonetheless, we checked our measurement methodology with an expert to ensure procedural validity.

5. Conclusion

The current study found that TTM performed by parents could lower stereotypical autism behavior and stress. Additionally, it could reduce difficulty in language communication, sociability, sensory and cognitive awareness, as well as improve health and physical behavior. Caregiver-based interventions by TTM may facilitate better relationships between children and their parents.

6. Ethical approval

The study was approved by the Khon Kaen University Ethics Committee for Human Research (HE632138).

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