

Pivotal Response Treatment Within Implemented Within Natural Environment Activity of Horseback Riding to Enhance Social Functioning of Children With Autism

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Abstract

This study examined the effectiveness of delivering Pivotal Response Treatment (PRT) in the natural environmental activity of horseback riding on social communication of children with autism spectrum disorder. We hypothesized that children provided with PRT in a natural setting (n= 8) would exhibit improvement in social communication compared to children who did not get the treatment (n= 8) following an 8- consecutive weeks of Pivotal Response Treatment delivered during horseback riding activity. The results of this study revealed that children participants demonstrated improvement in social communication as measured by Social Communication Questioner (SCQ) across three main domains: reciprocal social skills, social communication, and restricted ridged behaviors.

Keywords: Children with Autism. Pivotal Response Treatment (PRT). Horseback riding. Social Communication.

1. Introduction

Autism is a multifaceted developmental disability that negatively impacts the verbal and non-verbal communication and social interaction such as play or leisure activities among children. The unique characteristics of children who are diagnosed with Autism Spectrum Disorder (ASD) pose special challenges for those teachers and educators who serve them in the schools and for the caregivers who deal with them in a daily base (Howlin, 2006).

Social communication is the core deficit of ASD in which is defined broadly as an individual's ability to respond to social bids and initiates and maintain interactional discourse (Adamson, McArthur, Markov, et al., 2001; Bruinsma, Koegel, & Koegel, 2004; Jones & Schwartz, 2009). These impairments are typically manifested by difficulty in responding to verbal initiation exhibited by others, inappropriate facial expressions, lack of eye contacts during social interactions, and lack of joint attention skill; additional symptoms may include echolalia or an absence of verbalization (Koegel & Frea, 1993; Pierce & Schreibman, 1995). The delay in initial social communication skills affects the development of social language for children. With autism across the lifespan (Dawson, 2008; Mundy & Stella, 2000). Thus, providing children with autism with early intensive behavioral interventions has become a research priority. Research literature has accentuated the importance of improving social behavior at an early age in order to provide these children with the prerequisite communication skills needed for distinctive child development (Koegel, Vernon, & Koegel, 2009; Charman, Baron-Cohen, Swettenman et al., 2003; Mundy, Sigman, & Kasaire, 1999). Several intervention strategies have been supported by empirical research to increase the communication skills of children with autism.

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Other strategies incorporate procedures that are especially effective in encouraging social communication that are characterized by delivering the intervention in a natural environment, using natural reinforcements, and emphasizing the importance of direct and immediate reinforcements (Lovass, 1987; Yoder & Stone, 2006; Koegel and Koegel, 2006, and Prizant, Wetherby, & Rubin).

Pivotal Response Treatment (PRT) intervention is an example of an empirically, valid, behavioral intervention that is derived from a naturalistic language paradigm in which the intervention is implemented in natural environments. It is characterized by enhancing functional communication skills through utilizing each child's natural motivations. The emphasis of PRT approach is on delivering instructions in a natural context (Coolican, Smith, & Bryson, 2010). PRT approach is targeted to address the severity of autistic characteristics in several core areas. It aims to teach responses that resemble behavior that is more typical.

Underlying PRT is motivational strategies that are used to teach language skills, reduce disruptive or self-stimulatory behaviors, increase social communication skills, and increase academic skills (Koegel et al., 2006). Researchers identified several pivotal behavioral areas that when treated, produce large gains in desired outcomes due to the intervention: motivation in which the child is willing to engage interactively in social communication activities; social initiation in which child initiates participation in enjoyable activities; and self-regulation in that child can manage and monitor personal behaviors.

Motivation and self-initiation are the primary pivotal areas of PRT intervention. Initiating social motivation for children with autism is an essential value regarding the importance of being engaged in meaningful social interaction. Specific PRT motivational techniques include following the child's preferred items, varying task difficulties, rewarding and reinforcing immediately and continually, and delivering natural reinforcement that is related to the child's response. (Koegel, Camarate, & Valdez-Menchaca, 1998). Other pivotal areas include self-management and the ability to respond to multiple cues or prompts. By targeting the pivotal essential areas, individuals with autism can positively progress in other areas that are not targeted in the intervention (Koegel et al., 2006).

The most important aspect of PRT approach is that a child-directed approach that the child determines the direction of the therapy by making choices. The child determines the activities and objects that will be utilized during the intervention (Koegel et al., 2006). Children with autism often demonstrate a lack of verbal initiation required to prompt language acquisition. Therefore, enhancing their motivation with specific PRT techniques help them to initiate meaningful verbal communication and ensure the generalization of verbal initiation across different settings, stimuli, or people (Koegel, Camarate, & Koegel, 1998). The outcome of research studies gathering longitudinal data about children with autism suggests that the presence of verbal initiation could be a predictive indicator for more positive long-term social-behavioral outcomes. The results indicated the need for more board application systematic teaching interventions such as PRT intervention to foster child initiations (Koegel, Koegel, & Shoshan et al., 1999).

In a recent study by Voos, Pelphey, & Tirrel et al., (2013), researchers investigated the effect of PRT technique on social brain activity. By using functional Magnetic Resonance Imaging, they measured the social brain activities while delivering the PRT technique to two young children with autism. Results showed a positive impact on the neural mechanisms that support the social perception skills for both cases. Furthermore, there were more activities in the regions that are typically recruited by typical children during social perception process. These results support the conclusion that PRT is an effective procedure by verifying that permanent positive changes have occurred in the brains of children receiving PRT.

Moreover, Generalization and maintenance have been at the heart of the intervention core for children with autism. Therefore, implementing the intervention in a natural environment has given significant attention to responses provided by controlling the stimuli in the natural environment (National Research Council 2001). Also, motivational components in the PRT intervention package can be better promoted in the natural environment where children have their preferred activities and reinforcements (Koegel et al., 2006). Researchers observed that the natural environment paradigm leads to collateral intervention gains in targeted and non-targeted areas such academic, behavior, and social developments in addition to the generalized effect across individuals and settings (Baker, Koegel, & Koegel, 1998; Koegel, Koegel & Surratt, 1992; Koegel, O'Dell & Dunlap, 1988). Within a context of single-subject design, researchers conducted a study to examine the effect of incorporating motivational techniques with natural language paradigm on responses spontaneity and generalization for two nonverbal children with autism (Koegel, O'Dell, & Koegel, 1978).

The setting of this study included a clinic room directed by a clinician, and the generalization probes were monitored in a clinical room decorated as a living room. In both settings, the children were exposed to traditional learning procedures (i.e., directed by a clinician, structured activities, edible reinforcement) and natural language paradigm condition (i.e., directed by the child, attempts reinforcement, and natural reinforcement). The result of this study indicated that the children exhibited broad generalization gains within the natural language paradigm condition compared to traditional learning procedures. One of the critical features of the natural language paradigm is that generalization and maintenance are integrated within the intervention, making them habitually applicable in natural settings and with varied individuals (Camarate, 1995). The natural language paradigm supports more inclusion for children with disabilities. By implementing the intervention in a natural setting, these children have better chances of being included with typical individuals in community settings (Camarate, 1995).

Therapeutic horseback riding is one of the therapy approaches that emphasized the role of the natural environment is. It is an example of animal-assisted therapy that has been drastically increased during the last forty years (Prothmann & Fine 2011). Recent developmental research demonstrated that both typically developing children and children with autism show a natural interests towards animals and other nonhuman aspects in their environments (Melson, 2003). Therapeutic horseback riding has extended the effect of animal research on the social functioning of children with autism regarding using horseback riding as a treatment to enhance posture, balance, and mobility and laterally developing the therapeutic bond between the horse and the child with autism (Martin & Farnum, 2002). Riding a horse involved many skills such as self-control, attention and focus, sensory integration, and verbal/ non-verbal communication. It also consists of multisensory integration, contact with the horse, psychological stimulations, and social responses. Consequently, this type of therapy can benefit children with autism who exhibited deficits in joint-attention, social communication, and sensory integration and management (Prothmann et al., 2011).

Ward et al., (2013) conducted a study in 21 children with autism, they utilized single group quasi-experimental interrupted time series design to examine the associations between therapeutic horseback riding and social communication and sensory processing in children with autism. All children attended therapeutic horseback riding for ten consecutive weeks followed by a six weeks break to investigate whether or not children were able to maintain the therapeutic effect following the withdrawal of therapeutic riding effects. The teachers of this study conducted pre and post of two measures: Gilliam Autism Rating Scale: Second Edition (GARS-2) that was used to assess autism characteristics and Sensory Profile School Companion (SPSC) to measure children's sensory processing abilities. The results indicated that all children showed improvement in their social communication, tolerance, and sensory input reaction in which was also reflected on their learning in the classroom.

Since both interventions, Pivotal Response Treatment (PRT) and therapeutic horseback riding treatment are lined up with the latest research regarding the importance of natural environment in eliciting children with autism social communication. For this current study, the assumption is that integrating these interventions will yield a significant positive outcomes in the core autism symptoms that are social functioning, communication, and restricted behaviors.

The current study examined the effect of delivery Pivotal Response Treatment (PRT) intervention in the natural environmental activity of horseback riding on social communication of children with autism spectrum disorder. It is hypothesized that children provided with PRT in this natural setting would demonstrate improvement in social communication compared to children who were not treated.

2. Method

2.1. Participants and Setting

The participants of this study were 16 children with autism recruited from Al-Wafaa Center for Autism Related Disabilities. All participants met Autism criteria as an evidence of Gilliam Autism Rating Scale-Second Edition (GARS-2). Parents had to consent to pre-testing, eight weeks of the intervention, and one post testing session. The participants were randomly assigned to their experimental and control groups.

The experimental group consisted of 8 children three girls and five boys ranging from 6-10 years of age, while the control group consisted of 2 girls and six boys ranging from 6-10 years old. Participants in the experimental group received the intervention of Pivotal Response Treatment (PRT) during horseback riding activity, in a horse stable, for eight consecutive weeks, four times a week for one hour. All pre-test measurement was given to the caregiver in both the experimental and the control group before the intervention sessions were introduced. Also, post-test measurement of both groups conducted at the completion of 8 weeks integrated interventions.

2.2 Study Design

Cross-sectional quasi- experimental research design was carried out to examine whether the delivering PRT intervention during a natural leisure activity of horseback riding resulted in an increase in social communication for the experimental group compared to the control group.

2.3 Measures

Social Communication Questionnaire (SCQ) -Current Form was used to examine social communication functioning at pre- and post-integrated interventions. The Social Communication Questionnaire (SCQ) –Current Form is a 40-item parent report measure, yes/no format. It focuses on behaviors observed during the most recent three months of the child's life, therefore, determine changes of individual's behaviors due to the implementation of the intervention in three main dimensions: Reciprocal Social Interactions, Communication, and range of interests. Difficulty with Reciprocal Social Interactions defined as "Inability and/or a lack of desire to interact with peers;" communication deficits are defined as "Difficulties with both verbal and non-verbal social communication skills that includes responding to others, using gestures, taking turns when talking or playing, expressing emotions and feelings, staying on topic, asking questions, and making and keeping friends. Restricted, Repetitive and Stereotyped Patterns of Behavior is varied from stereotyped motor movements, such as hand-flapping, to behavior such as lining up or ordering objects, to preoccupation with a certain area of interest. The assessment is administered to parents in yes/no format.

About test reliability, The SCQ has a statistically significant correlation between the scale and its domains by calculating the correlation of the items with each other and the extent of their correlation with the total score of the measure of social communication. The correlations were statistically significant. Communication and Behavior Scale were 0.77, 0.48, respectively. The measure of behavior was also statistically significant with a communication scale of 0.53, indicating that the scale was fairly stable.

3. Procedure

Each child in the treatment group received four days a week, an hour per day of PRT intervention during a natural environment horseback riding activity over the span of 8 consecutive weeks. Different colors, shapes, size horses were randomly assigned to the children participants. Parents were asked to stay with their children in the horse stable for all the training sessions.

Prior the intervention sessions, the instructors were provided with brief training on how to deliver the PRT in the natural environment that is in our current study during the therapeutic horseback riding in the stable. The training included discussions regarding Pivotal Response Treatment (PRT) as a child-centered approach. Thus, instructors were instructed to guide, rather than direct the children during the delivery of the intervention. Training also included discussing specific strategies associated with PRT deemed to be promising interventions to enhance social communication skills. These strategies were motivational procedures such as considering the child's choices, providing natural reinforcement contingencies, and varying the difficulty level of tasks. Instructors were encouraged to think about what the child liked to play with or what they liked to eat or do to enhance the child's motivation required for meaningful social communication interaction. Also, instructors were encouraged to identifying specific goals and objectives for the children regarding object labeling and requesting. Children with autism often have sensory problems that minimized their attention to learn or participate in social-communicative context. Thus, therapeutic horseback riding is a very intense sensory activity to meet the children sensory needs hence enhance their attention and registration so they can be more aware of their surroundings and also more interactive with others. Also, horse stable is a very rich natural environment that is full of various stimulations such as environmental colors, different kind of animals, different texture and smells (e.g., trees, horses, sheep, cows, birds, and fertilizers, hay). Therefore, it was selected to be integrated with PRT intervention to enhance social communication of the children participants.

3.1. PRT Intervention Sessions

The key objective of this integrated intervention is to enhance social communication skills such as expressive/ receptive labeling, following action commands, request initiation, eye contact, joint attention, reciprocate/ initiating greetings in a general environmental setting so children can generalize their learning across various settings. Sessions were divided into three phases as follows: *Setting up (15 m)*

This was the first phase in which the participants had to be familiarized with the altered materials and tools in the stable that was lasted for 15 minutes. The goal of this phase was to reduce the anxiety of the horseback riding experience and be familiar with the environment around them. They were then encouraged to touch the shallow pan of shavings, squeeze textured balls, groom stuffed horses with real tools, ride a mechanical horse; the mechanical horse was used as a model for example to introduce the actual training. It also helped to determine what the best method is for each child to mount horses.

Mounting and quit riding

All participants were required to wear the helmets, horseback riding outfits, and boots. After successful mounting the horses, the participants were guided by their instructors for quite riding around the stable. Participants rode the horses with specific verbal cues, “hand on pommel,” “Foot in a stirrup,” “1, 2, three up and over”, and “Right leg over the saddle.” Participants were taken for ten minutes non-stop movement in the horses with no interaction unless necessary. They were encouraged to focus on horse movements to relax, accumulate the sights, smells, and motion of riding a horse.

(PRT)Instructions/ horseback riding (20 m)

The duration of this phase was 20 minutes, PRT instructions were provided to each child participant while they were riding the horses. The instructors and the horse guides were asked to follow the PRT principles. Specific PRT motivational techniques included: following the child’s preferred items, varying task difficulties, rewarding and reinforcing immediately and continually, and delivering natural reinforcement that is associated with the child’s response (Koegel et al., 1998). Participants were highly motivated to ride the horses. Thus, this was the reinforcement. The instructors and the horse guides stopped the horse movement and provided several opportunities for the children to communicate. For instance, “what is this?”; “which color is that horse?”; “point to the tree”; “what do you hear?”; “look at me”; “clap your hand.” When the child provides the answer or attends to the instructions, the horse guide or the instructors provide the child with the horse ride by pulling the horse rope.

PRT instructions were provided based on the child’s communication ability. Receptive communicative instructions were demanded from non-verbal children such as following commands, using gestures, eye contact, and initiate and reciprocate greetings. All children participants were encouraged to communicate and interact with the nature such as label the colors and numbers of the trees or flowers, and identify sounds they hear around them. They were also encourage to follow directions and imitate each other.

Closure

This was the last phase of the intervention that lasted for ten minutes; all participants were instructed to follow instruction such as dismounting the horses, taking off the helmets, feeding and brushing the horses. Different labels were reinforced for example “what are you feeding the horse? “Feed the brown horse” “put the brush in the bucket?” Also, participants were directed to play with each other, brushing the horse together, riding the same horse together, greetings and saying thank you to the instructors and other children.

4. Data Analysis

The Mann-Whitney U-test, and the asymptotic significance (2-tailed) p-value, was utilized to determine if the intervention led to an increase in social communication skills for the experimental group compared to the control group. A similar test was conducted to assess whether the intervention resulted in an increase in social communication skills for the experimental pre- and post the intervention. Also, Cohen's d was used as a measure of effect size to indicate the standardized increase within the experimental group from the pre-test to post-test.

5. Results

Concerning the following hypothesis: Delivering Pivotal Response Treatment (PRT) during a natural environmental activity of horseback riding will result in an increase in social communication of children with autism. As shown in Ranks table 1 below, the information regarding the output of the actual Mann-Whitney U test. It shows mean rank and sum of ranks for the two groups tested (i.e., the experimental group is $M=11.25$), and Control group is $(M=5.75)$. The table indicated which group had higher result in an increase in social communication of children with autism using (PRT), overall; namely, the group with the highest mean rank. In this case, the experimental group had the highest increase in social communication using the PRT within a natural environmental activity of horseback riding than the mean rank of the control group.

	Group	N	Mean Rank	Sum of Ranks
TOTAL POST	experimental	8	11.25	90.00
	Control	8	5.75	46.00
	Total	16		

As a follow up to provides if these two groups have significant differences between the scores in experimental and control group, the test statistic table 2, provides the test statistic, U statistic, as well as the asymptotic significance (2-tailed) p-value was calculated, specifically, to shows the actual significance value of the test. As shown in Table 2 below, it can be concluded that delivering the PRT intervention within a natural environmental activity of horseback riding for children with autism in the experimental group showed higher statistical significant than a control group at a mean level of $<0.05(U=10, P= .020)$.

	TOTAL POST
Mann-Whitney U	10.000
Wilcoxon W	46.000
Z	-2.319-
Asymp. Sig. (2-tailed)	.020
Exact Sig. [2*(1-tailed Sig.)]	.021 ^a

Similarly, as shown in table 3, there was a significant statistical difference between the pre- and post-tests in favor of post-test of the experimental group at the mean level of $<0.05 (P= .012)$.

		N	Mean Rank	Sum of Ranks
TOTAL PRE - TOTAL POST	Negative Ranks	8 ^a	4.50	36.00
	Positive Ranks	0 ^b	.00	.00
	Ties	0 ^c		
	Total	8		
		TOTAL PRE - TOTAL POST		
Z			-2.527 ^a	
Asymp. Sig. (2-tailed)			.012	

In addition, Cohen's d a measure of effect size was calculated to measure the effect of delivering the PRT intervention within a natural environmental activity of horseback riding for children with autism in the experimental group using the following equation: $Cohen's\ d = (9.75 - 17.5) / 6.242139 = 1.241562$. This result is equal to 0.53 at a mean level of <0.05 which indicated medium effect size.

6. Discussion

The overall results of this study supported the findings in the literature regarding the efficiency of PRT intervention for children with autism when delivered during a natural environment setting of horseback riding activity. This study's results indicated that delivering the PRT intervention within a natural environmental activity of horseback riding enhance the social communication of children with autism in three main domains; reciprocal social skills, social communication, and rapidity and restricted behaviors.

Regarding reciprocal social skills that was the core domain of the intervention outcomes, participants demonstrated a sustained level of directed attention to the environmental stimulus, and most importantly to the other children around them. Children participants exhibited interest on approaching each other, and they showed a level of imaginative play with the horses' toys and tools.

About social communication domain, children participants demonstrated an improvement on initiating/reciprocating greetings. Also, the frequency of requesting items and responding to questions was significantly improved (e.g., identify different labels, colors, and answer questions about horse anatomy.) Children participants were receptive and attentive to the instructions regarding providing eye contact and following directions, and providing verbal/ nonverbal commands either to the horses or the other children. The finding is also consistent with the literature regarding the effectiveness of task variation on increasing responsively to multiple cues and variation (Dunlap & Koegel, 1980). Since PRT is a multicomponent intervention that targets pivotal areas such as motivation, social initiation, and self-regulation to manage and monitor behaviors (L. K. Koegel et al., 1998). PRT also has a collateral effect in different areas of concern related to autism such as fostering children's communication and language, developing social-emotional abilities, increasing cognition, and improving behavior (Levy et al., 2006). More specifically, compared to the children with autism in the control group and comparison to the pre-post-test intervention of the experimental group. The observed increase in social communication might be attributed to several factors; first, horseback riding activity that was very stimulating activity in terms of being associated with physical attendance, texture, and the movement of the horses (Bass, Duchowny, & Llabre, 2009).

For all participants, the finding regarding the rapidity and restricted behaviors was consistent with the literature, horseback riding activity was perceived as a reinforcing stimulus that accounted for the high level of motivation and social interaction of children with autism which is the main principle of PRT intervention (Koegel et al., 2006). Other observed significant changes on participants were being less fixated with object-oriented, ridged routines. At the beginning of the intervention, the children were experiencing fixation difficulties and ridged behaviors that they do not want to smoothly transition between intervention sessions (e.g., mounting/dismounting the horse, or riding another horse color or shape). Towards the end of the intervention, all participants were more flexible with routine changes. This can be attributed to the fact that the horses demand a high level of active and physical movements to encourage the participants to break away their fixation and rigidity with routines (Bass et al., 2009).

Although there are not enough extensive supportive research studies regarding solely therapeutic horseback riding intervention to promote social communication of children with autism (Bass et al., 2009), the studies are compelling that PRT intervention, derived from the application of Applied Behavior Analysis (ABA) has a promising intervention gain. The confrontational point of the current research study was that since a horseback riding is an interactive leisure activity that can be utilized as a high motivator activity to enhance the attention and social skills of the children participants. In this study, horseback riding was utilized as an interactive leisure activity to facilitate social interaction in a natural environment. On the other hand, this activity demands motor learning skills, control skills, and social engagement in which, all in all, contributed to the social functioning gain. PRT principle of increasing responsively to multiple cues and variation of tasks can positively impact social communication and generalization skills across settings (Dunlap & Koegel, 1980).

There are some precisions that have to be considered in further research. Primarily, the relatively small number of children with autism took part in this study limits the generalizations that can be made regarding the setting and the activity utilized to deliver PRT intervention. It would also be beneficial to measure whether or not children participants have maintained the intervention gain across time. Further studies should increase the length of the intervention to examine whether or not a more intense form of the treatment would yield a greater improvement in social communication.

In spite of these limitations, the present study suggested that delivering the PRT intervention within a natural environmental activity of horseback riding enhance the social communication of children with autism, a more comprehensive assessment would be favorable to understand how the present intervention is specifically impacting the main domains of social communication. Additional research is needed to further document the effectiveness of delivering PRT instruction during horseback riding leisure activity.

7. References

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