

Psycho-educational Horseback Riding to Facilitate Communication Ability of Children with Pervasive Developmental Disorders

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In this study, we applied a novel psycho-educational horseback riding (PEHR) program to the treatment of four Japanese children with pervasive developmental disorders (PDD) in order to facilitate the acquisition of verbal and nonverbal communication skills. The behavioral changes in each child were evaluated using a psychological and behavioral scale. The scale for evaluating the effect of Human-Equips-Interaction on Mental activity (HEIM scale) was designed to assess the behavioral improvement of children based on the following 10 items: Human relationships, Imitation, Emotional expression, Sudden physical movement, Fixative behavior, Adaptation to change, Visual response, Fear or nervousness, and Verbal and nonverbal communication. After taking part in the PEHR program for several months, all subjects showed remarkably improved HEIM scores and marked improvements were observed in eye contact with others (instructors, side walkers, and leaders) in the riding area. A statistical difference was found in items 1, 2, 3, 6, 7, 8, and 9. However, no statistical difference was found in items 4, 5, and 10. As the program progressed, the children showed enhanced verbal and nonverbal communication skills, and became more expressive in their emotional and empathetic interaction with their parents. These observations suggest that the normal functioning of pleasurable emotions and empathy may facilitate further improvements in joint attention, imitation and empathy, and may result in successful verbal expression by PDD children. Therefore, horseback riding can play a very important role in the psycho-educational support required for the communication ability of PDD children.

Key words: animal-assisted therapy, autism, empathy, horseback riding for handicapped

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Pervasive developmental disorders (PDD) is a diagnostic category which refers to a group of five disorders including autism, Asperger's Syndrome, Rett Syndrome, childhood disintegrative disorder and pervasive developmental disorder not otherwise specified (atypical autism). These five disorders are characterized by delays in social and communicational behaviors [2].

Children and adults with PDD may have three types

of disabilities, i.e., social and interpersonal negotiation, communication, and imagination [3]. They thus may have difficulty from infancy to adulthood, in getting along with others, making it difficult for them to participate in social activities. Recently, animal-assisted therapies including horseback riding have demonstrated remarkable improvement in social activity or behavioral problems of PDD children in a variety of situation [4, 20, 26]. We established the HEIM Scale, a behavioral score for evaluating the effect of human-equips interaction on mental activity [15]. Based on the childhood autism rating scale (CARS)

[28], it was designed to objectively evaluate the psychosomatic effects of psycho-educational horseback riding (PEHR). The HEIM scale assessed the effects of PEHR on behavioral improvement based on 10 items: Human relationships, Imitation, Emotional expression, Sudden physical movement, Fixative behavior, Adaptation to change, Visual response, Fear or Nervousness, Verbal and Nonverbal communication.

We have already reported that, except for the factor of verbal communication, positive effects were recognized using the HEIM scale during a relatively short period after PEHR was applied to PDD children [24]. Verbal communication, however, reportedly does not show marked effects within such a short time frame [17].

Thus, in this study, we examined the effect of a new type of psycho-educational horseback riding program designed to facilitate both verbal and non-verbal communicational ability of 4 PDD children through evaluating behavior of these PDD children using the HEIM scale.

Methods

Subjects

Four children, two diagnosed with autism and two with PDD, were the subjects of this study, as shown in Table 1. This study has been approved by the Ethics Committee based on the ethical rules established by the Institute for Developmental Research, Aichi Human Service Center. The horses used in this study were carefully raised under conditions in accord with the law of animal welfare and administration. A detailed procedure of the PEHR program, the contents of the present study, and the possible risks such as falling off a horse that might occur while riding were carefully explained by the experimenters to all parents before the start of the study. All parents gave informed consent in writing for the participation of their children as subjects and to their own participation in

answering the questionnaire survey in this study and the publication of the study results.

Procedure of Psycho-Educational Horseback Riding (PEHR)

The PEHR program provides carefully-planned psychological and educational care for each PDD child while he/she is riding horseback. We began establishing a new psychological environment in which PDD children may readily recognize the face of their mother as the primary key in facilitating their communication ability. Once the children succeeded in recognizing their own mother, a further psychological and educational approach was then to encourage them to articulate the word “Mamma” to their own mother. Both a decrease in negative emotions such as fear, anger, distrust, and unpleasantness, and an increase in happy, safe, and pleasurable emotions together with the free expression of such emotions by PDD children are especially regarded as important factors in facilitating their communication ability.

Horses

The horses used in the PEHR program were a Kiso horse (Natsuka: age 10, female, height 138 cm, body weight 414 kg) and a Haflinger (Arthur: age 11, a gelding, height 148 cm, body weight 578 kg). The body weight was estimated using the following formula: [5]

$$\text{Body Weight (kg)} = \frac{\text{girth (cm)} \times \text{girth (cm)} \times \text{length (cm)}}{12,000}$$

The PEHR with the Kiso horse took place along a riding path (12 × 20 m) and another session performed using the Haflinger horse was conducted along a neighboring riding path (23 × 35 m). Both horses were well-trained therapy horses. The activity of both horses in the PEHR program was carefully restricted to within 2 hr per day, and behavioral and physiological stress signs of the horses were carefully checked by the stable keeper during the PEHR program. The horses were allowed to roam freely on the ground (about 45 × 70 m) during the rest of the day so that they might undergo the least amount of stress in their daily living

Table 1. Diagnosis and chronological age of each subject

	Diagnosis	Start of PEHR	Introduction of verbal communication program	Present age
Subject 1	PDD	7 yr 4 months	7 yr 4 months	8 yr 5 months
Subject 2	PDD	8 yr 6 months	8 yr 6 months	11 yr 7 months
Subject 3	PDD	4 yr 1 month	6 yr 6 months	9 yr 3 months
Subject 4	PDD	9 yr 1 month	14 yr 0 month	17 yr 0 month

situation.

Subjects mainly rode a Kiso horse and sometimes a Haflinger, depending on their psychosomatic conditions. The PEHR took place along a riding path on a gently inclined slope (22 m in length \times 17 m in width). Each child was allowed to mount and ride in the first session of PEHR, and then to ride three laps around the riding circle while the horse was led by the leader. One or two side-walkers walked alongside the horse to provide support and keep the child from falling off. The child then took a short rest before remounting for the second session. During the first session, the horse walked all the way around the first lap and trotted slowly during part of the second and third laps.

Psycho-educational games were introduced in the second session, and the children took part in the games while riding in the second and third laps. The games were carefully designed to fit each child's behavioral problems and interests. Two different gaits (walk and trot) were introduced into the PEHR program depending on the psycho-emotional condition of the child. In the third (last) lap, the child was free to pursue his/her favorite activities until the end of the second session.

The primary goal of this program was for the child to spontaneously call his/her own mother, "MOTHER". Thus, it was designed to lead the child to his/her mother with that single word as the outcome.

Three different stages of behavioral and psychological tasks with graded difficulty were involved. In the first stage, the child on horseback was to enjoy a game of trying to pick up small colored rings spread on a tray with a hook attached to one end of a rod (30 cm in length), and to transfer the rings to his/her favorite twig of a specially prepared tree branch. In the second stage, many toys (rubber fruits and animals, etc.) very popular with children were attached to the small rings and hung on the twigs of the branch in advance. In this game, the child riding horseback was asked "Which one is an apple?" by the PEHR leader, for example. The child then tried to snag the target object (an apple, in this case) using the rod with the hook. When the child succeeded in hooking the correct toy, the leader and side-walkers in unison would pronounce the name of the toy. In the third stage, a picture of the subject's mother attached to a ring was hung on a twig of the branch so that the rider could recognize her face. The child was asked "Which one is your Mamma?" by the leader. When the child succeeded in getting the

correct mother's picture using the rod with the hook, the leader and walkers alongside the horse would say "Mamma" in unison with a loud voice so that the child might gradually discern the association between the mother in the picture and the word "Mamma".

Then, teaching the child to call his/her real mother by the word "Mamma" was carried out as follows. The leader led the horse to the same place on the riding ground, then encouraged the child to call "Mamma!" to his/her mother, who was standing on the opposite side of the riding ground. If the child showed some reaction, the leader and side-walkers immediately praised the child together. Then, the child on horseback was allowed to trot all the way over to his/her mother, whereupon she praised the child as soon as the horse drew near her. In this situation, trotting is functioning as a pleasurable reward for the PDD children.

Evaluation by 10 different factors of the HEIM scale

The ten items of the HEIM scale were shown in Table 2. HEIM is a multiple-choice type of scale and each item (1 to 10) involves five different choices (1-5). Each choice (1, 2, 3, 4, 5) is given 1 point, 2 points, 3 points, 4 points, and 5 points, respectively. The evaluation by HEIM was carried out by the mother of each PDD child together with two experimenters in this study. The reliability of the HEIM score was examined using an intra-class correlation coefficient, with a high positive correlation coefficient being obtained, as in a previous report [15]. A statistical analysis was conducted to determine whether the HEIM scores of the post-PEHR program had increased compared with those of the pre-PEHR session using a non-parametric Wilcoxon's signed rank test.

Results

Figure 1 describes the behavioral changes measured using HEIM scores in the form of charts at the beginning of the PEHR program and at a certain period of time after experiencing PEHR. A statistical difference was observed in items 1, 2, 3, 6, 7, 8, and 9 ($P < 0.05$). However, no statistical difference was found in items 4, 5, and 10 ($P > 0.05$).

Subject 1

At the beginning of the program, this boy was 7 years and 4 months old. He could not make eye contact with

Table 2. HEIM scale

Item 1: Human relationship (with family while engaging in horseback riding)

1. Will not have any kind of relation with anybody.
2. Can not ride horse without a significant person (like mother) alongside.
3. Can ride only as long as a significant person (like mother) is within view.
4. Can ride without the presence of a significant person (like mother).
5. Can communicate positively with leadership of the family and can ride without any trouble.

Item 2: Imitation (physical movement while riding)

1. Does not show interest in any kind of approach from others.
2. Shows interest in other's approach but does not imitate physical movement of others.
3. Can hold reins when shown how.
4. Can control horse by manipulating reins to a certain degree.
5. Can perform physical exercise while horseback riding in imitation of physical movements of the side-walker.

Item 3: Emotional expression (way of smiling on horseback)

1. Shows facial expression of pain.
2. Does not show any kind of facial expression.
3. Shows facial expression of satisfaction.
4. Shows smiling face.
5. Shows broad smile of pleasure.

Item 4: Sudden movement (unnatural or forced physical movement while riding horseback)

1. Tries to get off horse immediately.
2. Can ride horseback for a very limited period of time if assisted by side-walkers but occasionally tries to dismount.
3. Does not dismount, but shows extremely vigorous physical movement on horseback.
4. Does not dismount, but shows a slightly unnatural physical movement on horseback.
5. Can ride horseback without any unnatural physical movement.

Item 5: Fixation behavior (fixation on objects not related to horseback riding)

1. Has strong attachment to a certain object and can not ride without it.
2. Has no strong attachment to a special object but always fixates on something and can not ride without doing so.
3. Has no strong attachment to a special object but always fixates on something and worries about it while riding.
4. Does not show any fixative behavior while riding, but evidences strong attachment to objects when the riding is over.
5. Does not show any fixative behavior either during or after horseback riding.

Item 6: Adaptation to change (adaptation to horseback riding)

1. Objects to horseback riding itself.
2. Can ride horse but does not show interest in doing so.
3. Shows own desire to ride by communicating by some kind of expression.
4. Arranges environment to pursue comfortable horseback riding.
5. Engages spontaneously and cooperatively involved in riding, bringing and arranging the mounting block.

Item 7: Visual response (attention to people)

1. Does not show any visual response toward any approach from others.
2. Watches person approaching but does not make any eye contact.
3. Makes eye contact with person approaching but does not respond.
4. Makes eye contact with person approaching and watches family member, but does not wave.
5. Makes eye contact with person approaching, watches family member and waves.

Item 8: Fear and nervousness (degree of crying or being afraid)

1. Acts very anxious and cries very hard for a long time.
2. Cries at first but stops after a while.
3. Face shows great anxiety.
4. Face shows slight anxiety.
5. Shows no fear.

Item 9: Verbal communication (degree)

1. Does not show any verbal expression when riding.
2. Shows some verbal expression when riding.
3. Says some words on horseback, but can't converse.
4. Can speak and converse to some degree with others when riding.
5. Can have very positive conversation with others when riding.

Table 2. HEIM scale (continued)

Item 10: Nonverbal communication (expression of own will via physical movements)
1. Shows no physical response.
2. Shows some kind of physical expression, although not related to wishes.
3. Shows some physical movement expressing satisfaction.
4. Appeals by means of physical movement in order to actualize his/her own wishes.
5. Appeals by means of physical movement according to the given situation, e.g., when trying to get what he/she wants or when not satisfied.

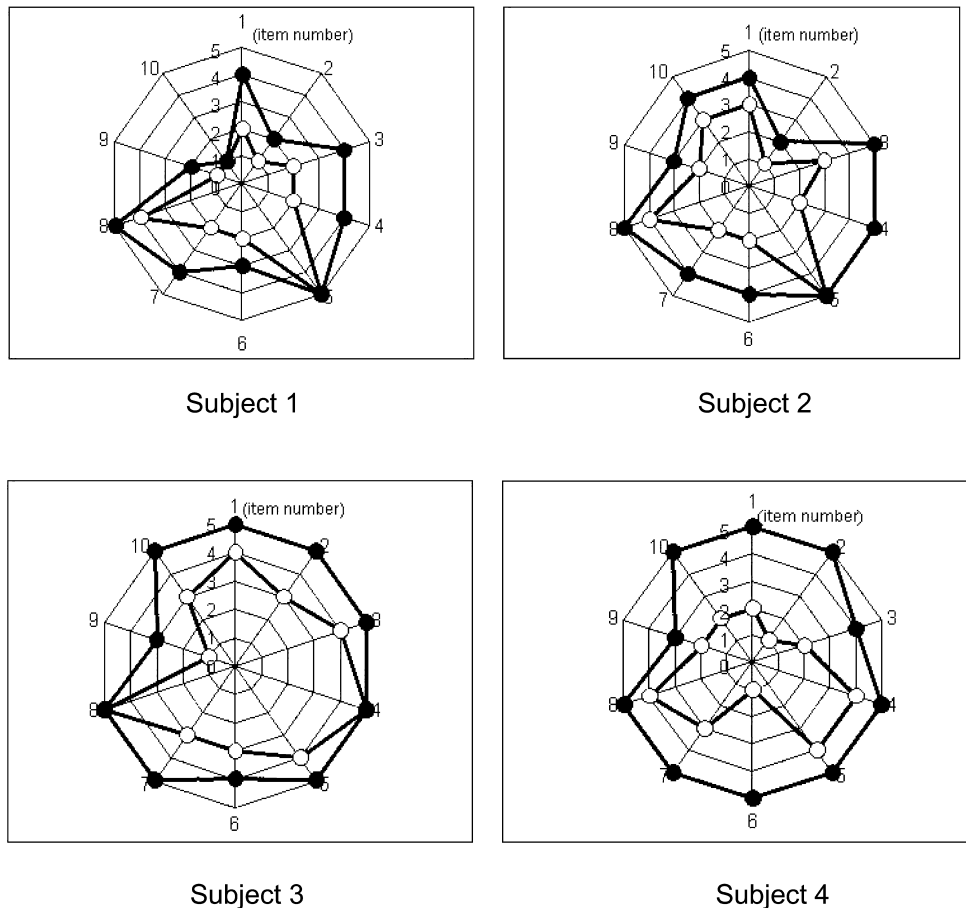


Fig. 1. Distribution of HEIM scores of pre- and post-PEHR program.
 The blank circles indicate the HEIM score at the beginning of PEHR and the solid circles indicate the HEIM score at some time after completing the PEHR program.

anybody and was unable to ride the horse unless he was accompanied by a family member such as his mother or father. When mounting the horse, he showed no intention to continue riding, and had almost no facial expression. He sometimes looked anxious and occasionally tried to jump off the horse. No verbal

expression was observed during the PEHR.

At 5 months into the PEHR program, the boy was able to make eye contact with a specific person who participated in the PEHR program as a helper standing at the same location in the riding ground during the PEHR program, even though he threw away all the toys

handed to him by the helper while he was riding. At 6 months, he became able to hang a lei around his mother's neck, and was able to give a "High five" to the other helper at the riding ground. At 11 months into the PEHR program, while riding he could make firm and steady eye contact with the helper who tried to give him toys. At this stage of the PEHR program, he was able to babble at some length. At 12 months, he could make frequent eye contact with his mother and would wave his hand and the pom-pom in her direction. He also became able to gently pat his mother on the head and smiled when people praised him for his warm and gentle behavior toward her.

Subject 2

At the beginning of horseback riding, when this boy was 8 years and 6 months old, he could ride unaccompanied by his mother or father, although he showed no interest in any kind of approach from others. Though he displayed a somewhat tranquil facial expression, he sometimes suddenly tried to jump off the horse. He showed no desire to ride horseback and made no eye contact with anybody. Although he uttered some sounds, they were not intelligible. After 1 month in the PEHR program, the boy was able to play the "Ring game" in which he was supposed to snag a ring passing through the pole. At 3 months into the program, he became able to pick up the proper ring with the color requested by the helper, and he smiled when the horse trotted. At 11 months, he could make eye contact with his mother when calling her "Mamma" at the same location on the riding ground. At home, he sometimes called his mother "Mamma" when he felt very relaxed and comfortable. After 24 months into the program, he made a verbal sound "Beep, Beep!" when he rode the trotting horse. At 25 months he became able to turn his head in the right direction when asked "Look at me!" His mother admitted that he had never behaved this way at home.

At 27 months, he smiled broadly when astride the trotting horse. At 29 months into the program, the boy started to babble considerably. At 32 months, he answered "Yes!" when requested to do something at home, and began to stare at a specific helper for a fairly long period of time, smiling more often and babbling more. At 34 months, he started making steady eye contact with other helpers as well as a specific helper. While riding, he also made steady eye contact with his mother or father standing in the distance. In response to the question, "Where is your mother?" he looked for

his mother and was able to make continual eye contact with her. At 37 months, the boy could not only give a "High five" to his mother when approaching her while riding but was also able to say "Mamma" in a very subdued tone of voice. This was the first word he had uttered since he began to participate in the program. Later, he repeatedly said "Mamma" when allowed to ride a trotting horse.

Subject 3

When he began horseback riding, this boy was 4 years and 1 month old, and was able to ride unaccompanied by his mother or father. He could understand the verbal instructions on how to hold the reins and often smiled while riding. However, he was unable to make eye contact with people trying to approach him, and exhibited no verbal expression. Eighteen months after the start of horseback riding, vocal utterances such as babbling were observed. At the age of 5 years and 8 months (19 months after the start of horseback riding), he was introduced to the PEHR program. At 3 months (22 months after he started horseback riding), he was heard to utter the word "Mamma" for the first time. The word itself, however, had only phonetic significance for the child who made no eye contact with his mother when he uttered it. At 7 months into the PEHR program, the child said "Forward!" when he wished to make the horse resume moving. At 16 months, he could understand the pictures of "orange", "banana" and "cake", and could also pronounce the words for them. The word "Mamma" was repeatedly uttered only when the picture of his mother was shown to him; he never said "Mamma" to his real mother. This subject quit horseback riding after 3 years because his family had to move away.

The follow-up interview of this subject a year later revealed that, though he still said "Mamma", his expression of the word was empty of any but phonetic significance. Moreover, he no longer uttered the words "orange", "banana", or "cake".

Subject 4

This boy started horseback riding when he was 9 years and 1 month old. At first, he could not ride unaccompanied by a family member, and even then he could only do so as long as he was allowed to hold hands with one of them. He showed no interest in the overtures of others and no facial expression while riding. Although he was able to establish eye contact

with people approaching him, the only sound he could make was “Woo”.

Forty-seven months after the start of horseback riding (14 years old), he was introduced to the PEHR program. The word “Mamma” was first heard 3 months later. Seven months into the program, he started to say “Mamma” while looking at her. At 11 months, he successfully said “Dad” while pointing his finger right at his father. Then, one month later, he added another dimension of feeling to the word “Mamma” when he felt lonely, asked a favor of her, or apologized to her. After 22 months, he was able to express contrary emotions by saying “No!” Other verbal expressions such as “Ouch!” were correctly used when he accidentally hit his hand. At 33 months, the child could say “What?” when he wished to know the name of an object that interested him.

Discussion

In this study, we found that social and communication behaviors were improved in PDD children after participating in the PEHR program. Among various behavioral and communicational improvements of 4 PDD children found, the improvement in eye contact could be a very important factor for PDD children to open their mind to the social environmental stimuli surrounding them. All four PDD children clearly scored higher on item 7 (visual response) in the HEIM after completing the PEHR program. Two children (Subject 1 and 2) succeeded in making eye contact with a person approaching and watched a family member, while the other two (Subject 3 and 4) further developed their communicational ability to wave to parents on the riding ground. Besides behavioral changes evaluated by the HEIM score, a careful observation and analysis of PDD children during the PEHR program using a video camera showed that the quality and social meaning of eye contact was markedly improved in two children (Subject 1 and 2). One possible interpretation why eye contact was improved in the PDD children after experiencing the PEHR program is that the cognitive and emotional meaning of the social and environmental stimuli surrounding them positively and pleasurably changed because they experienced and interpreted the world more positively.

Children with severe autism are generally considered to have difficulty in establishing relationships with

other people, and even their mothers fail to become a target of their interest. Autistic children are also thought to have difficulty in face recognition [12]; although they can distinguish objects [7], they can not distinguish the features of different people.

In general, PDD children may lack spontaneity in seeking to share enjoyment, interests, or achievements with other people, and may also lack social or emotional reciprocity [2]. PDD children have difficulty coping with changes in their natural and/or social environmental stimuli, and they show extreme resistance to such changes [13]. However, a subtle and well-prepared change may be accepted with no resistance by PDD children, therefore, we introduced some games with subtle change and graded difficulty in the PEHR program [16]. This experience during the program may have produced some tolerance in the PDD children to subtle change. In this way, the PDD children could learn that there would be no harmful stimuli that might irritate his/her psychological field of emotion when he/she wishes to express feelings and emotions during games in the program.

As the PEHR program proceeded in this study, the PDD children experienced a stable, peaceful, non-harmful, and non-threatening environment on the horseback riding track. The recognition of their environment, which changed from being “harmful” to “pleasant”, is a very important factor in aiding them to courageously seek to spontaneously share enjoyment, interests, or achievements with parents and later with important others. The children also learn that they are free to express their own feelings and emotions and that emotional reciprocity with their parents will always be accepted with pleasant feelings expressed by parents and other people participating in the PEHR program. These cognitive and emotional changes of PDD children can lead to the formation of a cognitively interpreted “positive field of emotion” [10] in these children in the PEHR program.

Recently, animal-assisted therapies have often been introduced into medical treatment. For example, such therapy has been used to reduce the psychological stress of patients facing an operation [21]. Aphasic patients have improved their communication skills because of the positive influence of a dog used in therapy [18]. For children with autism, various types of animal-assisted therapies have been introduced into the treatment process [4, 20, 26], with many positive effects being reported. The positive effects of these animals may have the same psycho-emotional

mechanism related with the positive field of emotion. However, horses or other large animals that take part in animal-assisted therapies may bring about better effects on the social and communicational ability of PDD children than therapies with relatively smaller animals such as dogs or cats. The reason for this is not clear, but a possible interpretation can be made based on the theory of musical empathy [10].

Horses can readily show obedient and slow movements in contrast to the quick and unexpected movements of smaller animals such as dogs or cats. Thus, the presentation of changeable and irritating stimuli produced by small dogs or cats may partially destroy the formation of a positive (pleasurable) field of emotion in PDD children and may result in less positive effects. However, large dogs can also be possible good candidates for therapy of PDD children because their movements are slow, less changeable and more predictable [9].

Once the positive (pleasurable) field of emotion was established, PDD children adopted a new strategy of changing their cognitive and emotional evaluation of new stimuli. Thus, PDD children regarded the new stimuli as non-harmful and non-threatening. As a result, PDD children experiencing PEHR may try to spontaneously share enjoyment, interests, or achievements, and social or emotional reciprocity with parents.

In fact, the PDD children in the PEHR program who had not successfully established an interpersonal relationship may first develop an intimate relationship with a horse rather than a person. They then gradually establish interpersonal relationships with people (in this case, the leader and the side walkers) who supported them in the PEHR. Ultimately, these children showed improvement in their social and communication behaviors with people. In the PEHR program, especially when the horse was trotting, PDD children started smiling and facially expressed their joy and pleasure. Then, they became eager to express their joyful feeling physically or verbally by babbling and, in the advanced stage, with meaningful words. They also became very willing to convey their happiness to their parents and looked for positive emotional responses in their parents' facial expressions through eye-to-eye contact.

Autistic children with no oral language by the age of 5 can rarely develop spoken language in the future [1]. Moreover, the emergence of spoken language is very delayed in children with autism [23], making their

acquisition of social communication skills very difficult [14]. Thus, in one sense, it may be much more productive to introduce complementary and alternative communication skills such as sign language to continue efforts at verbal communication.

On the other hand, an increase in the vocabulary of autistic children has been demonstrated in play therapy [11], and communicational ability has been demonstrably improved when some types of psycho-educational approaches were used [29]. Furthermore, the capacity for both verbal and bodily expression of children with autism improved through psycho-educational horseback riding [19].

The two essential points of psycho-educational horseback riding are: 1) to guarantee and maintain a safe and secure environment for the PDD children during the PEHR and 2) for PDD children themselves to experience the feeling of being safe and secure with the persons most important to them such as parents or the leader of the PHER program.

Moreover, PDD children were reported to have some mirror neuron dysfunction [25]. Mirror neurons have been considered to reside in Broca's area, one of the motor language fields [27]. Some abnormalities in the ability to copy motor movements [30] and types of motor defects have been reported in children with autism [22]. In normal language development, Broca's area is considered to be activated when babbling occurs as a precursor to articulating words [8]. The difficulty of language development in PDD children seems to be deeply related to the findings mentioned above. Incidentally, we observed more frequent babbling in most PDD children during horseback riding with no verbal expression, including the four children featured in this study.

It has been speculated that Broca's area may be stimulated through the children's symmetrical and rhythmical body movements while riding. This, in turn, suggests that the introduction of the psycho-educational approach of asking a child to say "Mamma" should be started soon after babbling has been observed in the PEHR process. It is reported that joint attention ability plays a crucial role in language development in autism [6], and some semblance of speech has been reported through the training of autistic children in joint attention [31].

In the present study, we introduced a task in which a child on horseback, accompanied by the trainer, instructor and side-walkers all together try to find his mother so that the child can keep attention focused on

her while the word “Mamma” is being called. At first, the child never looked toward his mother, but gradually responded to verbal cues such as “Where is your mother?” from the instructor and side-walkers, and then started to look for his mother. Once he succeeded in looking in her direction, the child on horseback was allowed to trot his horse up to his mother and was then praised by her. Then, when the child responded to the word “Mamma” spoken by the trainer and others and initiated his own physical or verbal expression, the others expressed their own happy feelings and praised his success in accomplishing the task.

These interpersonal relationships seemed to facilitate the induction of empathy for others among the children with autism. The psychological and interpersonal atmosphere of our riding activity program is very warm and comfortable. Once the PDD child recognizes it to be a safe and secure environment, negative emotions such as fear, anger, distrust, and unpleasantness that formerly monopolized his or her emotional responses and behavior tend to disappear. Instead, other brain functions, such as pleasant emotions and feelings of empathy come to the fore. Therefore, once the fundamental functions for language ability such as joint attention, imitation and empathy are activated in the mind of PDD children, some form of verbal expression is virtually guaranteed. Therefore, for whatever reasons, horseback riding may play a very important and useful role in providing psycho-educational support for improving the communication ability of PDD children.

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