A One-Year Prospective Follow-Up Study of a DIR/Floortime™ Parent Training Intervention for Pre-School Children with Autistic Spectrum Disorders

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Objective: *Determine the results of 1-year Developmental, Individual-Difference, Relationship-Based (DIR)/Floortime™ parent training in developmental stimulation of children with autistic spectrum disorder (ASD).*
Material and Method: *Thirty-four, two to six years old children with ASD participated. Parents were encouraged to deliver 1:1 interaction according to their child's developmental level, as they were modeled and coached. Pre-post videotapes were rated by blinded assessors.*
Results: *Thirty-one families completed the present study. The data showed that adding home-base DIR/Floortime™ intervention at the average 14.2 hours/week for one year could help 47% of the children to make good improvement (1.5 Functional Development Level, FDLs or more), with 23% making fair progression (1 FDL), and the last 29% making poor progression (0.5 FDL or less). There were significant increases in children's total Functional Emotional Assessment Scale (FEAS), and Functional Emotional Developmental Questionnaire (FEDQ) scores and there was significant decrease in the Childhood Autism Rating Scale (CARS) scores ($p \leq 0.001$). It showed that fidelity of the parents, severity of the children, and baseline developmental status might affect the outcome.*
Conclusion: *Adding home-base DIR/Floortime™ intervention at the average 14 hours/week for one year helped 47% of children with autism to make good improvement in their development, and decreased autism's severity significantly.*

Keywords: Autistic spectrum disorders, Parent training, Home-based intervention, DIR/Floortime™

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Autistic spectrum disorders (ASD) is a neurodevelopmental disorder that results in significant lifelong disability. Progress has recently been made in the earlier identification of children with ASD[1,2] and many children are now first identified in the pre-school period[3]. ASD has diverse clinical manifestations, behavioral phenotypes, and developmental dimensions. They have compromised in the foundations of relating, communicating, and thinking, such as a difficulty with reciprocal social communication as part of a relationship and frequently evident superficial symptoms such as repetitive behavior, self-stimulation, and self-absorption[4,5].

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There is growing consensus that young children with ASD benefit substantially from comprehensive and intensive therapies. Most of such interventions have concentrated on behavioral approaches, known as applied behavior analysis (ABA), typically focusing on repetitive practice and a highly structured form of trial presentation[6-11].

Despite its impressive effects in teaching important behaviors to children with ASD, the highly structured of the behavioral discrete trial model encountered problems with generality. Some of the problem noted included cue dependency, lack of spontaneity, and self-initiated behavior, rote responding, and failure to generalize behavior gains across contexts[12,13].

More recently, the child-initiated interventions in natural settings were developed. Such efforts yields more generalized responses, increased spontaneity, and flexibility[14-18]. Another benefit of these naturalistic approaches is the ease with which they can be learnt

by caregivers and can be incorporated into the child's everyday life.

The prototypical social-pragmatic approach is represented by the Developmental, Individual-Difference, Relationship-Based (DIR) model of Greenspan and Wieder[15]. DIR focuses on relationships, social skills, and meaningful, spontaneous use of language and communication and integrated understanding of human development. The integrated model of human development includes interaction with caregivers and the environment, biological motor and sensory differences, and the child's functional emotional developmental capacities. In addition to the study of 200 children with ASD[15], there are new studies using a relationship-based approach that incorporate fundamentals of the DIR/Floortime™ model and they have shown positive results for children with ASD[17-20].

In Thailand, almost all of the hospital and special education nurseries use ABA as their main systematic treatment. These 20 to 40 hours per week of intensive intervention represents the gold standard of treatment. This approach is not feasible for most of the families in Thailand where there is a national shortage of personal trained in these approaches. Most of the autistic children in Thailand have 1-on-1 intervention by the ABA trained personal only 1 to 3 hours per week. Some institutes provide additional training of parent intervention in specific skills with a range of intervention approaches involving parent in behavior management, promotion of communication skills that are non-intensive, and utilization of teaching in everyday situations.

DIR/Floortime™ approach has recently been introduced in Thailand. A pilot randomized controlled trial showed that adding home-based DIR/Floortime™ intervention on routine care at the average of 15.2 hours/week for three months could make significant gain in all three measures employed in the study: Functional Emotional Assessment Scale, Childhood Autism Rating Scale and the Functional Emotional Developmental Questionnaire[19].

Until more developed, institutionalized DIR/Floortime™ services are available in Thailand, a staged approach to intervention, using parents as first interventionists may be the most practical way to deliver initial services.

Objective

The aim of the present study was to determine the results of a one-year DIR/Floortime™ parent training for an additional benefit in encouraging children with ASD climbing the developmental "ladder" and declining in the autistic behaviors and to find out the factors that might affect the outcome such as age, severity, and family factor.

Material and Method

Ethics approval

The present study was approved by the Institutional Ethical Committee of Mahidol University. Written informed consent was obtained from the children's parents before enrollment in the present study.

Participants

Subject recruitment was done by paper advertising the DIR/Floortime™ model shown at the National Institute for Child and Family Development, Mahidol University, Thailand. The parents who were interested in this new treatment method could call in for registration or more information.

The children whose diagnoses were confirmed by a developmental pediatrician and met clinical criteria for Autistic Disorders and Pervasive Developmental Disorder, Not Otherwise Specified according to the Diagnostic and Statistical Manual (DSM) IV[21] were invited to participate in the present study if they were 2 to 6 years of age. The children were excluded if they had any additional medical diagnosis (*e.g.* genetic syndromes, diagnosed hearing impairment, diagnosed visual impairment, or seizures), or they were geographically inaccessible for follow-up visits, or if their parents were not literate or had known chronic psychiatric or physical illness.

Sample size calculation

The improvement in Functional Emotional Assessment Scale (FEAS) Ratings (the child part) was used as the primary measure of overall progress for the children. A gain of one or more levels of functional development within a one-year period was clinically significant.

From literature review, baseline FEAS scale score was 3.5 and an approximate SD was 2[20]. The sample size calculation was 34.

Intervention

The target treatment is a DIR/Floortime™ parent intervention developed by Greenspan and Wieder for children with ASD. The first author, who has degrees in Rehabilitation Medicine, had been

trained in the DIR/Floortime™ from books and the Floortime™ DVD series[22-24] and had practiced this technique as a home consultant for two years at the beginning of the present study.

The present study treatment involved intervention entirely with parents of children with ASD, rather than directly with the children themselves. Before the first session, all parents in the intervention group had to learn about DIR/Floortime™ model through 3 hours DVD lecture prepared by the first author. The lecture consisted of the basic concept of DIR model, the biological challenges of the children with ASD in terms of sensory reactivity, processing of the sensory data and planning motor responses. This lecture also included the details of Greenspan's six functional developmental levels (15): 1) Self-regulation and interest in the world, 2) Engagement and relating, 3) Purposeful emotional interaction, 4) Social problem solving, 5) Creating ideas, and 6) Thinking logically.

At first visit, the parents were trained for 1.5 hours. They were trained to observe their autistic children's cues, follow the children's lead, and implement the Floortime™ techniques that were appropriate for their children's current level of functional development to achieve the goals.

If the children were not being able to calm down nor were they being cared for, their parents would be encouraged to do Floortime level 1: joining the children in the myriad little thing that gave them pleasure and maintaining mutual attention and engagement. Floortime 1 contributed to milestone 1 and 2.

If the children could not engage in two-way gestural communication, did not express many subtle emotions, or could not open and close many gestural communications in a row, their parents were encouraged to do Floortime level 2: using simple communication through animated face-to-face interaction with increasing back and forth communication. This achievement correlated with milestone 3 and 4.

If the children could not engage in pretend play and/or used words to convey intentions or wishes, the parents were encouraged to do Floortime level 3: helping their children to express needs, wishes and feeling through pretend play and using their ideas in daily conversation. This achievement correlated with milestone 5.

If the children could not connect their thoughts logically and hold a conversation for a period of time, the parents were encouraged to do Floortime level 4: helping their children become logical and critical thinkers. This achievement correlated with milestone 6.

All of the parents were advised to help their children exhibit these aforementioned skills through all range of emotions.

Because the children with ASD do not naturally master the milestones in complete sequential order, some parents had to learn more than one technique to promote their children's development.

Modeling involved the investigator showing parents how to use Floortime™ with the children. After parents observed the investigator modeling the skills, they were asked to do it by themselves. Coaching involved the investigator observing the parents playing with their children and giving them feedback about their performance.

In addition, activities for semi-structured problem-solving to enhance affect-based communication skills of the children and to improve basic neurological problems were selected from the manual for each family. The manual was based on the affect-based language curriculum (ABLC)[25]. The goals and home program were set for each family and they were asked to carry out their Floortime™ and semi-structure problem solving activities with a minimum of 20 hours per week.

If the parents had any questions about their children, they could ask the investigator in the website. Every question was answered within one day.

Three hours group meeting was arranged for Floortime™ user every month. In each meeting, the parents and the investigators had an opportunity to share their idea and discuss about their problems.

The participants were followed-up one on one at the end of first and third month, after that they were followed-up every three months. At each follow-up period, the investigator feedback to the parents how they relate to their child. Controlling intrusive responses were replaced with responses aimed at facilitating two-way emotional signaling and communication between parents and their children. Modeling and coaching were used to improve their performance. The goals, method, and technique of home program were refined to synchronize with the child's progress.

The participant received the present study intervention in addition to ongoing routine care of one on one treatment intervention based on behavioral and discrete trial principle throughout the present study period.

Measurement

Baseline demographic data included the children's profiles and their families' characteristics: marital status, having siblings or not, educational status of the mother, working status of the parents and participation in a special education (or regular) preschool program.

Primary outcome measurement

The Functional Emotional Assessment Scale (FEAS) Ratings (the child part)[26] was used at the beginning of the first session and at the end of the present study to measure changes in children's functional development. The FEAS is a valid and reliable, age-normed, clinical rating scale that could be applied to videotaped interactions between children and their caregivers. A 15-minute videotaped child-parent interaction was collected for each child. Each parent was asked to play with their child as they normally would at home, using a standard set of toys (including symbolic, tactile and movement play materials).

The FEAS (the child part) has six sub-tests directly related to Greenspan's Functional Development Level (FDL): 1) Shared attention and regulation; 2) Engagement and relating; 3) Two-way gesture communication; 4) Social problem solving; 5) Emotional idea and; and 6) Logical thinking. According to Greenspan, typically developing children achieve shared attention and regulation between zero and three months, which would correlate with FDL 1. FDL 2 is achieved between two and five months. FDL 3 is achieved between four and nine months. FDL 4 is achieved between nine and 18 months. FDL 5 is achieved between 18 and 30 months and, FDL 6 is achieved between 30 and 48 months. The children with ASD are delayed in their functional development; their FEAS score will be lower than would be expected of a same age typically developing children.

The assessment team consisted of two developmental psychologists with experience in assessing children with autism. They were blinded to the children's group status (pre or post intervention). Intraclass correlation coefficient was applied to test the agreement between two raters. Data from 20 random chosen subjects was analyzed and it was found that the correlation coefficient was 0.96.

The FEAS total scores were changed to FEAS scaled score based on a predetermined sub-scale scoring system (Table 1). Scaled FEAS scores provide estimates of functional developmental level (FDL) using 0.5 increments from FDL 1 through 6. The difference between the increments determined the clinical progression.

The ratio of the children who made good improvement (1.5 FDLs or more), fair progression (1 FDL) and poor progression (0.5 FDL or less) was shown as primary outcome.

If any child did not show progression at the end of the present study, consensus between two investigators and the parents was made about the main cause of the failure;

1) Quality of the intervention (if the investigator could not change the parent' style of engaging and relating after modeling and coaching or the parent cannot schedule their time for the child)

2) The child's problem (if both investigator and the parent hardly engaged and related to the child)

3) The problem of assessment (if both investigator and the parent agreed that the child's overall developmental status was marked higher than the day the DVD was recorded)

Secondary outcomes measurement

The Childhood Autism Rating Scale (CARS)[27] was used by the second author who had the degree of developmental pediatrician to rate the degree of autistic symptoms on a scale of 15 to 60. The

Table 1. Assignment of scaled scores based on sub-scale FEAS scores

Functional developmental level	FEAS possible score by level	FEAS score to obtain 0.5 level score	FEAS score to obtain 1 level score
1	14	5-10	11-14
2	16	6-12	13-16
3	8	4-6	7-8
4	4	2	3-4
5	14	4-7	8-14
6	10	2-3	4-10

decrement of the follow-up score from the baseline score was used to determine the improvement.

Developmental rating of the children was estimated by the parent at baseline and at the end of the study using the Functional Emotional Developmental Questionnaire (FEDQ)[28]. The questionnaire was related to Greenspan's six Functional Development Level (FDL). The increments determined the clinical progression.

The original version of the FDEQ was translated into Thai by the first author and then translated back into English by a fluent English speaker. The Thai version was tested for its validity by three health care professionals who had worked in the field for more than three years and by one parent of the child with ASD. All of them agreed that the FEDQ had face validity; they appeared to measure the fundamental development of the children. After they examined each items of the questionnaire to find the content validity, it was found that the intra-class coefficient of each item varied from 0.75 to 1. Then the content validity of the Thai version FEDQ was accepted.

Parents of the participating children were asked to rate their satisfaction on three-point Likert scale to assess their satisfaction of the effectiveness of the intervention of their child.

Compliance and co-intervention

At first visit, the parents were supplied with a set of three monthly logs in order to help them estimate the average number of hours per week they used Home-based DIR/Floortime Technique as well as any other methods of interventions for their child. The caregivers were asked to complete the log sheet at the end of the present study. Families consistently reporting 14 or more hours per week will be rated as high fidelity, seven to 13 hours as moderate fidelity, and less than seven hours as low fidelity.

Because it was nearly impossible to control the co-intervention, the input from other health and education services (*e.g.* part-time placement in a nursery, kindergarten) were reported.

Results

Baseline characteristics

Table 2 summarizes the demographic data of the children with ASD and their families. On average, children were aged 50.6 months (SD = 13.9). The gender make-up was 7.5: 1, male to female ratio. Twenty-three of 34 children (67.6%) were diagnosed with autistic disorder. The remaining children were classified with Pervasive Developmental Disorder, Not Otherwise Specified (PDD-NOS).

In the sub-category of the overall status, the proportion of the children who had maximal function as 1) only intermittent engagement, 2) intermittent reciprocal communication, and 3) islands of symbolization were 23, 38, and 38% retrospectively.

Approximately 80% of mothers had a bachelor degree or higher and 50% of the children had siblings.

Withdrawal

Thirty-four children diagnosed with autistic spectrum disorders from the National Institute for Child and Family Development were recruited within eight month and enrolled to the present study. Three families did not complete the year-long follow-up. Reasons for withdrawal from the present study included no one was available to use this technique

Table 2. Baseline characteristics of the children with ASD and their families

Variables	
The children	
Mean age in months (SD)	50.6 (13.9)
Average hour per week (SD) of paramedical services (*e.g.* speech (or regular) preschool program therapy, occupational therapy)	2.6 (1.8)
Gender (male/female)	30/4
Diagnosis (autism/PDD-NOS)	23/11
Overall status	
No affective engagement	
Only intermittent engagement, no reciprocal communication	8
Intermittent reciprocal communication, no symbolization	13
Islands of symbolization	13
On medication	9
Participation in special education	20
Their families	
Mother has bachelor degree or higher	27
Mother in full or part-time employment	19
Two-parent household	27
Sibling in family (yes/no)	17/17

The data are present in number except children's age and hour per week of paramedic services.

with the children so the parents decided to drop out of the study (n = 2) and dissatisfaction for the children progression (n = 1). The withdrawal was considered as a failure of the intervention then the outcomes of the child who dropped out of the present study were estimated as a worst-case scenario (zero gain in all outcome measures). Thirty-four subjects were analyzed in the present study.

Other program and intervention

During the study period, 59% attended either full-time or part time special education or (regular) preschool program. All of the children also received a mixture of services including one on speech therapy, occupational therapy or other treatments based on behavioral principles with 2.6 hours/week (SD = 1.9).

Primary outcome

Based on scaled FEAS scores, 47% of the children (n = 16) made good improvement (1.5 FDLs or more), with 23% (n = 8) making fair progression (1 FDL) while the other 29% (n = 10) made poor progression (0.5 FDL or less). In case of poor progression (10 cases), the authors concluded that the main cause of seven cases was due to the quality or quantity of the intervention, two cases was due to the problems of assessment, and one case was due to the difficulty in engaging and relating the child.

Secondary outcomes

Median, minimal, and maximal scores for the other outcome variables are shown in Table 3. There were significant increases in children's total FEAS, scaled FEAS, and FDQ scores over one year follow-up and there was significant decrease in CARS scores ($p \leq 0.001$).

Of the 34 families, 50 percent (n = 17) were very satisfied with their children's overall progression, 41 percent were somewhat satisfied, 9 percent were dissatisfied.

During the present study, the intervention group performed the DIR/Floortime™ intervention at an average of 14.2 hours/week (SD = 7.8). The authors

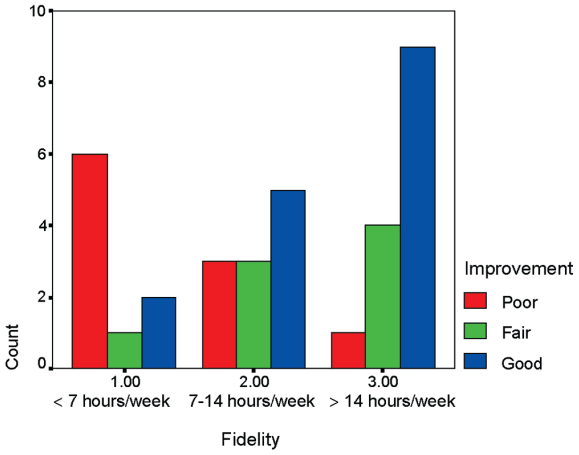

Fig. 1 Parents' fidelity in delivering the weekly hours of intervention and the degree of improvement (good = improvement 1.5 FDLs or more, fair = improvement 1 FDL and poor = improvement 0.5 FDL or less)

compared the results of the present study to parents' reports of fidelity in delivering the weekly hours of intervention. It was found that the more hours per week of intervention the better the gain in FEAS scaled score (Chi-square for trend, p = 0.007).

Association between baseline characteristics and primary outcome were analyzed by using Pearson-Chi square for binomial data, Chi-square for trend for interval data, and one-way ANOVA test for continuous data.

There were statistical relationships between the gain in FEAS scaled score and baseline CARS score (p = 0.020), overall status (p = 0.028) and drugs use (p = 0.027). The data showed that the less severe or the higher level of overall development of the children at the beginning of the present study had better gain from the intervention.

While not statistically significant, the presented data suggest association between the gain in FEAS scaled score and the baseline FEDQ (p = 0.07) and the clinical diagnosis (autistic disorder or PDD-NOS) (p = 0.093).

Table 3. Median, minimal and maximal scores for other outcome variables and primary outcome

	Pre	Post	Wilcoxon signed rank test
Median FEAS (min, max)	20.50 (5.00, 47.00)	28.25 (9.50, 58.50)	$p \leq 0.001$
Median FEDQ (min, max)	37.00 (19.00, 64.00)	48.00 (24.00, 74.00)	$p \leq 0.001$
Median CARS (min, max)	37.00 (30.00, 51.00)	34.00 (24.00, 47.00)	$p \leq 0.001$

There was no statistical relationship between the primary outcome and other baseline variables including sex, age, education and working status of the mother, having sibling or participation in school or not.

Discussion

The present study is an extension of the authors' previous work, which showed that after the parents added home-based DIR/Floortime™ intervention at the average 15.2 hours/week for three months, the intervention group made significantly greater gains in all three measures employed in the study than the control group[19].

The authors prolonged the present study period to one-year in order to find out the degree of improvement in the children's development. As the authors' previous study could show the benefits of the newly added intervention, the authors thought that it might not be justified to have the control group.

The results of the present study showed that the improvements in FEAS score, FEAS scaled score, FEDQ, and CARS were statistical significant pre to post. For typically developed children, one level of FDL level naturally occurred within six to 12 months. When a child moved from FDL 2 to FDL 3, this showed a change from being in isolation towards being able to express his/her emotion and have two-way communication with his/her parent.

On the scaled FEAS scaled score, 70% of the children in the present study gained one or more level of FDL within a 12-month period. These progressions were both considered by way of a statistical and clinical significance.

Our data demonstrated better results for lesser severely affected children in the same way as the previous reports of the interventions for children with ASD[11,29,30] and suggested that parents who were able to spend more time with their children could help their children to make a better progression.

The results of Solomon's study shows that 45.5% of the children participating in his project gained one or more level of FDL. Our children seemed to show better result within the same duration. The main reason was because, at baseline, our children lacked adequate and appropriate treatment or they went to school too early and spent more time in school than those in Solomon's study. Many children in this study participated in special education or regular preschool program even while they were not yet fully engaged with their parents. In such a situation, the teacher or teacher's aides could not conduct one on one interaction with each child, and the partially engaged autistic child was being left self-absorbed most of the time.

In addition, it was found that the majority of the parents in the present study did not know how to play with their children at the beginning. They spent most of their time controlling and teaching their children. This may be the results of Thai culture and education background that do not prefer the young to express themselves but rather do only what adults told them to do. This was different from the parents in Solomon's study. As a result, the parents in the present study had more chance to improve their abilities after being coached.

However, 30% of the children in the present study showed unfavorable outcome. The authors concluded that these families needed more time and better skill of the interventionist for coaching, modeling, and counseling in order to help them change their styles of engaging, relating, and communicating with the children.

There were a number of methodological limitations. First, without a control group, it is impossible to know whether the change in all outcome parameters are directly attributed to the home-based training. Furthermore, there was some confounder, varying types, and amount of interventions in the control group and the treatment group that consisted of varying amounts of the intervention.

In the authors' previous study, almost the entire control group received a mixture of services including one-on-one therapy based on behavioral principles 3.3 hours/week, which was similar to the present study. The average change of the FEAS score was only 0.3 points within a three month period if the data of two contaminated cases were not included for the analysis[19]. The literatures also suggested that giving up to 10 hours of intensive intervention[6] or receiving traditional school-based programming alone[31,32] did not substantially affect the course of the children with ASD's development. Thus, the results of the present study cannot be explained on the basis of natural course of improvement.

Families in the present study used DIR/Floortime™ in addition to their children's routine, behavioral treatment. It is possible that it was not the DIR training specifically, but simply more time spent with parents and more time spent in intensive intervention that was responsible for the gains that the intervention group showed.

For the outcome measurement, there were also some limitations on this issue. The authors' main

measurement was the FEAS, which is DIR-theory-specific. No information on other important aspects was measured, for examples, cognitive and social functioning, school performance, competing demands of other children, work, and their family life.

In terms of patients' fidelity, the data was only from the parents' record. Researchers were unable to verify its reliability. The actual number of hours spent on study intervention for significant improvement was difficult to be concluded.

Generalizability of the present results is a significant question. A number of potential sources of bias were operating in the present study. In particular, most of the parents in this study were socially advantaged, well-educated, and having one parent who was not working outside. In addition, the families in this pilot study were volunteers and thus more likely to get the benefit from a parent training model.

In conclusion, this trial confirmed the replicability of the home-based DIR/Floortime™ intervention across sites. It partially showed some variables that might affect the outcome such as fidelity of the parents, severity of the children with ASD, and baseline developmental status may be associated with favorable or unfavorable responses on interventions.

Potential conflicts of interest

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การติดตามผลการส่งเสริมพัฒนาการเด็กออทิสติกระดับปฐมวัยโดยฝึกให้พ่อแม่ใช้เทคนิค DIR/Floortime กับเด็กเป็นระยะเวลา 1 ปี

กิ่งแก้ว ปาจรีย์, แก้วตา นพมณีจำรัสเลิศ

วัตถุประสงค์: *การศึกษานี้มีวัตถุประสงค์เพื่อประเมินผลการฝึกสอนพ่อแม่ในการส่งเสริมพัฒนาการเด็กออทิสติกที่บ้านด้วยเทคนิค DIR/Floortime*

วัสดุและวิธีการ: *ครอบครัวของเด็กออทิสติกอายุ 2-6 ปี จำนวน 34 ครอบครัว เข้าร่วมงานวิจัย โดยพ่อแม่ของเด็กได้รับคำแนะนำและสอนแสดงวิธีการส่งเสริมพัฒนาการลูกที่บ้าน ซึ่งเน้นให้มีปฏิสัมพันธ์แบบตัวต่อตัวตามระดับขั้นพัฒนาการของลูก การประเมินหลัก คือ พัฒนาการของเด็กในภาพวีดิทัศน์ ซึ่งผู้ประเมินไม่ทราบว่าภาพวีดิทัศน์ที่ประเมินนั้น ถ่ายทำตอนเริ่มการวิจัยหรือตอนสิ้นสุดการวิจัย*

ผลการศึกษา: *เมื่อครบ 1 ปี มี 31 ครอบครัวเข้าร่วมการวิจัยจนจบ เมื่ออนุมานว่าครอบครัวที่ยกเลิกการวิจัยก่อนกำหนดนั้นไม่ได้รับผลดีจากการรักษา พบว่าการส่งเสริมพัฒนาการเด็กออทิสติกที่บ้านด้วยเทคนิค DIR/Floortime โดยเฉลี่ย 14.2 ชั่วโมงต่อสัปดาห์ เป็นเวลา 1 ปี ช่วยให้เด็กออทิสติกร้อยละ 47 มีพัฒนาการดีขึ้นในระดับดี, ร้อยละ 23 มีพัฒนาการดีขึ้นในระดับพอใช้ และร้อยละ 29 มีพัฒนาการดีขึ้นน้อย การประเมินพัฒนาการด้วยแบบประเมิน Functional Emotional Assessment Scale (FEAS) และ Functional Emotional Developmental Questionnaire (FEDQ) พบว่าเด็กมีพัฒนาการดีขึ้นอย่างมีนัยสำคัญทางสถิติ ($p \leq 0.001$) และผลการประเมินความรุนแรงของภาวะออทิสซึมด้วยแบบประเมิน Childhood Autism Rating Scale (CARS) พบว่าเด็กมีความรุนแรงของภาวะออทิสซึมลดลงอย่างมีนัยสำคัญทางสถิติ ($p \leq 0.001$) ตัวแปรที่อาจส่งผลการพัฒนาเด็กด้วยเทคนิคนี้ ได้แก่ จำนวนชั่วโมงต่อสัปดาห์ที่แต่ละครอบครัวใช้ส่งเสริมพัฒนาการให้เด็ก ความรุนแรงของภาวะออทิสซึมและระดับพัฒนาการของเด็กก่อนเริ่มการวิจัย*

สรุป: *การส่งเสริมพัฒนาการเด็กออทิสติกที่บ้านด้วยเทคนิค DIR/Floortime โดยเฉลี่ย 14 ชั่วโมงต่อสัปดาห์ เป็นเวลา 1 ปี ช่วยให้เด็กออทิสติกร้อยละ 47 มีพัฒนาการดีขึ้นในระดับดีและความรุนแรงของภาวะออทิสซึมลดลงอย่างมีนัยสำคัญทางสถิติ*