

Article

Effects of home-based rope therapy on children with special educational needs

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Abstract: Rope Therapy, a novel complementary therapy, combines professional rope techniques and professional comprehensive sensory integration training program, treatment, and training programs for people with special educational needs for the sake of enhancing their vestibular sense, proprioception, muscle tension, and whole body coordination ability by stimulating the brain nerves and secretion of neurotransmitters. **Method:** Rope therapy is conducted with the model “Home-based Rope Therapy Program” for 12 weeks. Parents who attended this program are required to accept training and assessment. To conduct the therapy independently, parents have to learn how to use the tools of this home-based rope therapy and interact with children during the training. In this study, children had intensive rope exercise training at home with positive feedback from parents within this period leading to higher emotional control and concentration level, more eye contact, and emotional and wording expression. The family would also receive feedback from the teachers, other professional trainers, and sports coaches related to the condition of the children. **Result:** A total of 69 families participated in the survey with children aged 4 to 26, including those who were diagnosed or had a suspicion of the autism spectrum, hyperactivity and inattention, dyslexia, and other special needs. After 12 weeks of home training, the result showed that the child’s concentration levels and control of negative emotions have been significantly improved. Meanwhile, it has been proven that the “Home-based Rope Therapy Program” is effective in bringing positive interactions and emotions to children and families. **Conclusion:** “Home-based Rope Therapy Program” provides children with intensive rope exercise training at home, satisfying children’s physical and sensory needs. Also, this program increases children’s exercise in muscle strength, balance, and coordination leading to higher concentration levels and high-quality parent-child time, thereby improving school children’s emotional control and concentration, and enhancing family harmony.

Keywords: rope therapy; SEN; special education needs; psychology; COVID; ASD; ADHD

Foreword

During the period of COVID-19, numerous day-to-day activities were suspended. Schools had been closed. Park and other entertainment facilities were closed. Significant social services were also suspended. During this period of lockdown, children are not allowed to go to the park to play and attend regular sports classes or other social activities. Their homes become the only area for entertainment. Parents may also bear the responsibility of teachers and tutors for teaching their children. After experiencing such an unprecedented amount of parent-child time, many parents were experiencing mental disturbance under stress.

Relevant studies have shown that children generally have issues with lower concentration levels, and behavioral and emotional problems, and spend a greater amount of time on electronic products during the time of COVID-19. The quality of life among children (including physical function, emotion, social and physical, and mental condition) has declined significantly compared to the situation before the epidemic. Since the amount of exercise has decreased and sleep quality has deteriorated, the mental disturbance of parents has also increased significantly, especially for families with children with special educational needs. On the ground that required rehabilitation training and medical treatment services are affected, children's behavioral and emotional problems at home become more severe, and parents are under greater mental disturbance than ordinary families (Tso et al., 2022).

The circumstance of the drastic changes in daily life like school closure, the significant reduction of outdoor activities, and how these changes affect parents' mental state negatively could give rise to deterioration of sleep quality and more severe Symptoms related to special educational needs (Davoody et al., 2022; Scriberras et al., 2020). Studies have also found that children and teens spend less time exercising and the outdoor activities. In contrast, they spend more time on television, social media, and games, and experience more sadness/depression and loneliness compared with the period before COVID-19 (Hupp et al., 2002).

Exercise can bring lots of benefits to our daily life. Children and adolescents should engage in at least 60 minutes (accumulated) of moderate and vigorous physical activity every day. Physical exercise does bring upsides to executive function, including working memory, selective attentional inhibition, and cognitive flexibility (Ludyga et al., 2020). Meanwhile, these physical activities could stabilize mood and provide calming and regulating effects (Hoza et al., 2015). It could also increase sleeping Quality, strengthen stress management, and raise emotional/social interaction (Moriguchi, 2014; Shield et al., 2016).

Studies have shown that exercise can reduce the behavior of overactive and inattentive school children, having the effect of increasing attention levels, and social and cognitive functions (Becker et al., 2020; Bremer et al., 2016; Liu et al., 2021). Also, the research found that exercise is beneficial for children with autism spectrum. For instance, It is an effective behavioral intervention for adolescents and adolescents (Tse et al., 2021). Studies during the COVID-19 pandemic pointed out that compared with children who do not exercise, children who engage in physical activity have a lower risk of hyperactivity and inattention, showing Exercise may help reduce behavioral symptoms in school-aged children (Bellomo et al., 2020).

1. The birth of rope therapy

In response to the distress caused by the various lockdowns during the COVID-19 pandemic for families with children with special educational needs and the need for daily training and physical activity to benefit the behavior management of children with special educational needs, A project was launched in late 2020 Rope Therapy brings an alternative complementary therapy option to families of schoolchildren with special educational needs.

Rope Therapy is an innovative treatment program that combines professional rope technology and a professional comprehensive theory of sensory integration training. It is particularly designed for people with special educational needs, aiming at strengthening vestibular and proprioception, muscle tension, and body coordination ability by stimulating the development of brain nerves and the secretion of neurotransmitters through different treatment items (Appendix A).

Background/Rationale

In the rope therapy, concentration, emotional regulation, family harmony, and sleeping quality would be evaluated to analyze the effectiveness of the rope therapy of children with special educational needs in which the scale of Children's quality of life scale parent questionnaire would be able to measure these 4 factors accurately. Here are the research question and hypothesis:

Research question 1: After the 12-week rope therapy, would SEN children's concentration, emotional regulation and sleeping quality be improved?

Hypothesis 1: Yes, their level of concentration and emotional regulation have been significantly improved.

Research question 2: After the 12-week rope therapy, would the level of family harmony significantly increase?

Hypothesis 2: Yes, the level of family harmony increased significantly.

Research question 3: After the 12-week rope therapy, would the level of sleep quality significantly increase?

Hypothesis 3: Yes, the level of sleep quality increased significantly.

2. Methodology

2.1. Methods

The execution of rope therapy includes 45 min of one-on-one rope therapy training in the rope therapy center. All people who execute rope therapy must be qualified rope therapists who have completed the training courses and assessments of the Rope Therapy Association. The "Home-based Rope Therapy Program" targeted at this study provides parents with training on equipment assembly and operation rope skills. After completing the assessment, they are qualified to be able to safely and independently implement relevant treatment projects at home.

In the "Home-based Rope Therapy Program", children undergo intensive rope therapy training at home. The equipment is designed for enhancing vestibular sense, proprioception, muscle tension, and whole-body coordination ability which is an interesting game for children (Appendix A).

2.2. Study design

The setting of the experiment would be the participants' homes. The equipment used is an industrial rope access equipment system, where ropes and associated equipment originate for working at height (Appendix A). The primary objective when using rope access methods is to plan, manage and carry out the work with a goal of no accidents, incidents, or dangerous occurrences for working at height.

2.3. Participants

The subjects are those who have been officially diagnosed with Autism Spectrum disorder (ASD), Attention Deficit/Hyperactivity Disorder (ADHD), or both with 69 participants in total (**Table 1**).

To track the effect of rope therapy on children with special educational needs, parents are required to fill in the quality of life scale based on their observations of their children from a certain link before the start and every two weeks during the program”. This scale is designed regarding the Children’s Quality of Life Scale Parent Questionnaire (Kiddy KINDL) (see Appendix B).

In this survey, the data provided by the parents before the start of the program was compared with the data provided after the 12-week home training being analyzed by paired t-test.

Setting (Appendix A)

The location would be at participants’ homes.

Table 1. Background information of respondents ($n = 69$).

	Amount of people	Male (%)	Female (%)
6 years old or below	7	4 (57.1%)	3 (42.9%)
6 to 12 years old	54	46 (85.2)	8 (14.8%)
12 years old or above	8	7 (87.5%)	1 (12.5%)
Total amount of people	69	57 (82.6%)	12 (17.4%)

2.4. Result

A total of 69 families participated in this survey (**Table 1**). The age distribution of children ranged from 4 to 26 years old, including diagnosed or suspected autism spectrum, hyperactivity and lack of concentration, dyslexia, and other special needs. Some children only have one special educational need, and some children have more than two special educational needs. Among the participants, there were 27 ADHD, 35 ASD, and 8 dyslexia children (those who have multiple special needs have been included.) (**Table 1**).

Originally, 89 participants were required to attend this experiment. However, due to the withdrawal of the 12-week experiment and the limitation of setting at home, 69 families completed the 12-week rope therapy as the analytic data (**Table 1**).

2.5. Research analysis

After 12 weeks of home training, the result shows that the child’s concentration level has improved significantly, while their negative emotion has been reduced, and having more emotional control (Appendix A). It is also effective in bringing positive interaction and emotions (see **Table 2**).

Paired *t*-test was adopted for investigating the level of concentration, emotional regulation, family harmony, and sleep quality of the participants with special educational needs.

Table 2. The significant change of quality of life.

	Mean	Mean	Mean difference	t	p-value
	Before Rope Therapy Intervention	After 12-week of Rope Therapy Intervention			
1. My child is very concentrated and focused	2.506	3.014	0.508	3.705**	0.000
2. My child feel strong and full of energy	3.272	3.551	0.279	2.82*	0.006
3. My child runs and jumps around a lot and has a high level of physical activity.	3.222	3.464	0.242	2.67*	0.009
4. My child love interacting with others	3.395	3.609	0.214	1.81	0.075
5. My child is able to successfully complete what he/she needs to do.	3.198	3.406	0.208	1.81	0.075
6. My child is very nervous and agitated.	2.778	2.507	-0.271	2.25*	0.028
7. My child has an exaggerated reaction to things that need to be done and cannot control his/her emotions.	3.000	2.536	-0.464	3.219**	0.002
8. My child and I argue and fight with each other.	2.753	2.246	-0.507	3.136**	0.003
9. My child felt angry towards me.	3.074	2.507	-0.567	3.159**	0.002
10. When my child is disciplined, they may feel angry or resistant.	3.370	2.913	-0.457	2.675**	0.009
11. My child feels happy and often laughs.	3.605	3.812	0.207	1.934	0.057
12. When my child feels unhappy, he or she would seek comfort from me.	3.506	3.725	0.218	2.18*	0.033
13. I can be very patient with my child and understand them.	3.259	3.667	0.407	3.341**	0.001
14. My child and I share a deep, affectionate relationship.	3.765	3.986	0.220	2.252*	0.028

* $p < 0.05$, ** $p < 0.01$.

2.6. Concentration

In the results of the quality of life scale filled out by parents, the child's concentration and concentration (with a full score of 5 points) rose from an average of 2.51 points at the beginning to 3.01 points. The level of concentration has improved significantly ($t = 3.705$, $p < 0.001$); Several parents reported that it was difficult for children to concentrate on an online class at home, and they would not interact with teachers and classmates during COVID-19. After this program, they focused more and actively involved in the classroom, and they can also listen and execute parents' instructions revealing the speed and ideal effect of home-based rope therapy.

2.7. Emotional regulation

After the intervention of home-based rope therapy, the score of items of "My child overreacts to things that need to be done and cannot control his emotions" ($t = 3.219$, $p < 0.01$), "My child and I were arguing and fighting with each other" ($t = 3.136$, $p < 0.01$), "My child got angry with me" ($t = 3.159$, $p = 0.002$) and "When my child is disciplined, he will feel angry or confrontational" ($t = 2.675$, $p = 0.009$) has been significantly reduced, showing that this program can effectively reduce children's negative emotions and violent reactions.

Parents reported that when their children had negative emotions, they used to express their emotions through physical aggression before attending this program.

After the training of the therapy program, the child will be more aware of their emotions and try to control them using words instead of physical aggression to express their negative emotions.

Parents also shared that children's emotional outbursts at home have been significantly reduced. There is a positive change in emotional management. In the past, the mood will suddenly explode from 1 to 100. Now it can be 60, or 70, and even could understand others' feelings by having empathy.

2.8. Family harmony

The implementation of the "Home-based Rope Therapy Program" has changed the form of traditional treatment inside a treatment room into home-based (Appendix A).

Parents become therapists for children's home training. During the treatment, the equipment has to be a targeted treatment design. With such professional equipment, this treatment time could also be a playtime for both parents and children having both effects of maintaining positive parent-child interaction and treatment effect (Appendix A).

The survey data reflected that the score of "my child is happy and laughs a lot" ($t = 1.934, p = 0.057$) was calculated from the beginning of the treatment to the end of the treatment.

The previous 3.605 rose to 3.812, with an increase of 5.73%. It does reflect the positive emotions that rope therapy brings to schoolchildren.

In terms of parents, the increasing score of "I can get along with my child very patiently and understand him" ($t = 3.341, p < 0.01$) and "My child and I share a loving, warm relationship" ($t = 2.252, p < 0.05$) showed that most Parents can be more patient with their children cultivating positive family interactions.

Since parents acted as therapists and help the children with the treatment, there is little tension in the overall home-based rope therapy. Although the parent training has already provided interactive and parent-child communication skills for the rope therapy on.

Coincidentally, the effect of the "home-based rope therapy program" also varies with family conditions, which is a fact that this variable of the survey cannot rule out.

2.9. Sleep quality

Our research found that the sleep quality of school children did not significantly improve after rope therapy. Interestingly, some parents' sleeping quality has improved after rope therapy.

It reflects that the child's sleep quality improved during the two weeks when the child participated in the project with relatively high physical demand.

The children's sleeping quality is evaluated by the parent's observation and response to the child's sleep status. In the future, a fitness tracker is recommended for assessing how rope therapy affects sleeping quality.

A scientific approach revealed that a sufficient amount of exercising would stabilize our emotions and improve sleeping quality (Banno et al., 2018).

3. Discussion

Research question 1: After the 12-week rope therapy, would SEN children's concentration, emotional regulation and sleeping quality be improved?

Hypothesis 1: Yes, their level of concentration and emotional regulation have been significantly improved.

Research question 2: After the 12-week rope therapy, would the level of family harmony significantly increase?

Hypothesis 2: Yes, the level of family harmony increased significantly.

Research question 3: After the 12-week rope therapy, would the level of sleep quality significantly increase?

Hypothesis 3: Yes, the level of sleep quality significantly increased.

Responding to the first and second hypotheses, the statistic significantly revealed that the level of concentration, emotional regulation, and family harmony has been improved. As for the third hypothesis, participants' sleeping quality did not significantly improve.

It was found that the level of concentration and emotional regulation and family harmony has been improved after a 12-week rope therapy experiment. Previous research also uncovered that a higher level of emotional regulation would improve family harmony while concentration was positively correlated with emotional regulation.

3.1. Limitation

There could be observer bias. When parents were invited to conduct this rope therapy with children they were informed that this therapy could increase their concentration level and emotional regulation, parents or therapy executors would have these expectations. As a result, some parents may just subjectively feel that the concentration level has been increased and have better emotional regulation. Their subjective feelings may affect how they respond to the scale provided. Furthermore, another limitation of this study is the relatively small sample size of 69 participants. While efforts were made to recruit participants from the target population of children with special educational needs, logistical challenges and constraints limited the feasibility of obtaining a larger sample. Despite this limitation, the study still yielded statistically significant results, providing valuable insights into the effectiveness of rope therapy in this population. Future studies with larger sample sizes are recommended to further validate and generalize these findings.

3.2. Conclusion

The survey also found there are positive effects of sports on children with special educational needs. Training in sports could improve children's executive function, attention level, social and cognitive function and stabilize their emotions, and even cultivate a calm mental state and regulation (Contreras-Osorio et al., 2021; Chan et al., 2023).

“Home Rope Therapy Program” provides children with intensive rope exercise training at home to satisfy children’s physical senses/sensations, increase children’s physical strength, balance, and coordination, enhance attention level, and establish high-quality parent-child care during family time. Conducting the therapy, reflected that rope therapy can effectively improve the quality of life revealed by the result of the quality of life scale which was completed by parents. Not only that, their concentration, emotional control of school children, emotional expression, and verbal expression among those students who studied at school have been significantly improved after 12 weeks at home.

There is also other positive feedback from parents (see Appendix B).

The results of this survey, coupled with the parents’ sharing of the effects of the rope therapy during the process, are indeed a blessing for our entire team.

Inspiring, we still hope that more research will be done in the future to understand more about the benefits of rope therapy programs for children in all aspects.

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Statement: We affirm that this research project is entirely original and has been conducted with utmost integrity and adherence to ethical standards. We have diligently avoided plagiarism, data manipulation, and any compromise to the validity of our findings. All necessary permissions and approvals have been obtained, and participant privacy has been protected. We uphold the highest ethical standards, comply with regulations, and aim to contribute to scientific advancement.

Conflicts of interest: The authors declare no conflicts of interest.

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Appendix A: Procedure of rope therapy

Home-based Rope Therapy Program

Home-based Rope Therapy Program hosted by 360 Access International Company Limited, which is the first Rope Therapy Centre authorized by Rope Therapy Association (RTA).

The Home-based Rope Therapy Program lasted for 12-week, in these 12 weeks, children were experiencing 6 different Rope Therapy Training items, which are Spin Board 轉轉轉飛板, Ascending on Rope 百米上攀, Popeye Pull 大力士, Superman 超人飛, Surfing Balance 滑浪好手 and Inversion on Hammock 反轉筋斗雲.

All Rope Therapy Training items involve stimulation to vestibular sense, proprioception, muscle tension and whole body coordination ability; but every single training item has its own specific training purpose.

Spin Board, Superman and Inversion on Hammock mainly provide different axis of vestibular input; Ascending on Rope and Popeye Pull aim on muscular training; Surfing Balance enhances balancing and core-muscle building.

Appendix B: Children's quality of life scale parent questionnaire (Kiddy KINDL)

Well-trained rope therapist should be responsible for filling in this scale. Please read the instructions carefully and select 'Never', 'Seldom', 'Sometime', 'Often' and 'Always' based on your observation of the participants with special educational needs.

- 1) My child is very concentrated and focused
- 2) My child feel strong and full of energy
- 3) My child runs and jumps around a lot and has a high level of physical activity.
- 4) My child love interacting with others
- 5) My child is able to successfully complete what he/she needs to do.
- 6) My child is very nervous and agitated.
- 7) My child has an exaggerated reaction to things that need to be done and cannot control his/her emotions.
- 8) My child and I argue and fight with each other.
- 9) My child felt angry towards me.
- 10) When my child is disciplined, they may feel angry or resistant.
- 11) My child feels happy and often laughs.
- 12) When my child feels unhappy, he or she would seek comfort from me.
- 13) I can be very patient with my child and understand them.
- 14) My child and I share a deep, affectionate relationship.

Appendix C: Images of rope therapy

