


Research Paper: A Family-based Telerehabilitation Program for Improving Gross Motor Skills in Children With High Functioning Autism Spectrum Disorder


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ABSTRACT

Introduction: Children with autism spectrum disorder (ASD) experience problems in motor skills which can affect other abilities such as academic and daily life skills. In this regard, the cost of interventions and the long distance from the rehabilitation centers put pressure on the family of children with ASD. Previous studies have shown the potential for using telerehabilitation as a more affordable way to provide interventions for children with ASD. Therefore, the present study aimed to investigate the non-attendant family-centered Sports, Play and Active Recreation for Kids (SPARK) motor program intervention to develop gross motor skills in children with a high-function ASD.

Materials and Methods: The research is a quasi-experimental study with a pretest-posttest design. The participants were 9 families of children with high-functioning ASD referring to the rehabilitation centers in Tehran, Isfahan, Quds, and Kermanshah provinces, Iran. Telerehabilitation of SPARK motor program involves exercising and playing performed in 24 sessions of 45 minutes each (3 sessions per week) for 8 weeks applied for parents. The test of gross motor development-2 (TGMD-2) was used for data collection. The collected data were analyzed by paired t-test.

Results: The results showed that family-based telerehabilitation of the SPARK program significantly improved gross motor skills in children with high-functioning ASD ($P < 0.05$).

Conclusion: It seems that the telerehabilitation of SPARK can be helpful for families who do not have access to rehabilitation centers.

Keywords: Family-based, SPARK, Gross motor skills, Autism spectrum disorder

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1. Introduction

According to the fifth edition of the Diagnostic and Statistical Manual of Psychiatric Disorders (DSM-5), autism is defined by persistent deficits in social communication and social interaction in multiple contexts and restricted and repetitive patterns of behavior [1]. This disorder appears early in childhood and disrupts or limits the daily functions of the individual [1]. In addition to interaction and social communication deficit and restricted and repetitive patterns of behavior [2-7], motor skills are among the other areas in which children with ASD most often have problems [8-12]. Although the impairment of motor skills in children with ASD is evident, it has not been addressed as the main defect in this disorder [13]. Previous studies have shown the relationship between motor skills defects and deficit in socialization skills [14], adjustment and adaptive skills [15], physical endurance [16], communication delay [17], and development of language [18, 19] in the children with ASD. Also, a study demonstrated that the quality of life of mothers of autistic children is significantly associated with the severity of the disorder and occupational performance of children [20]. Gross motor abilities are critical for major body movement such as running, walking, playing, coordination, and maintaining balance. Attention to the motor skills of children with ASD is important because motor problems are associated with dyspraxia [21], social-communicative skills [22], adaptive behavior skills [15], and cognitive skills such as imitation [23]. Also, Fulceri et al. [24] revealed that motor skills as moderators of core symptoms in children with ASD are related to stereotyped behaviors and expressive language.

Therefore, providing early comprehensive interventions to reduce motor problems in children with ASD seems necessary [11]. However, one of the issues that families of children with ASD face are the high cost of health care and the rehabilitation services for children with ASD [25, 26]. In Iran, psychotherapy and rehabilitation services are not covered by insurance, so families undoubtedly feel this pressure. Because of the lack of financial resources of the family for receiving services and lack of adequate support from responsible organizations, many of these children may not receive the proper and comprehensive treatment they needed. The financial burden of receiving services for the diverse and long-term needs of children with ASD, along with factors such as the severity of the disorder, the extent of signs and comorbidities, and conditions of autism in children, are among the most critical factors that increase stress

and reduce the quality of life in families that have a child with high function ASD [27].

One of the ways to overcome these obstacles is the non-attendant intervention or teleintervention, which can reduce the cost of referring to health care and rehabilitation centers, saving time, increasing access to remote areas provide health care, and provide the possibility of receiving long-term services in the natural context of life with low price for all those [28]. In this method, the interventions are taught to parents or family members by telephone, and the family members play the role of therapist or child instructor. Various interventions have shown that this method is helpful for children with ASD [28, 29]. The National Research Council of the United States (2001) has identified "parenting education" as one of the essential components of the success of interventional programs for children with autism disorder [30]. Since the family spends the most time with the child and can provide the most comprehensive interventions at the lowest cost, family-based interventions have been given more attention [31]. Family-centered service gradually emerged from the core of the family system theory, based on two principles of empowerment and assistance [32]. The welfare of the family is determined by the well-being of the child [33]. Family-centered service is a philosophy and a supportive method that emphasizes the relationship between parents and supporting organizations [34]. In this approach, each family can be involved in the choice of services that they like and decide on their children. Thus, the family feels control over the situation and understands the positive changes of behaviors that have been created due to the child's abilities and functions improvement [35].

Arvin and Rohbanfard [36] reported that 12 weeks of intervention of the SPARK program decreases the oxidative stress level in children with mild intellectual disability. Alipur and Rahimian [37] have demonstrated that the SPARK program had a more significant impact on improving motor proficiency and traditional games had a more significant impact on improving social development. Hung KN and Fong [38] reviewed the current evidence on the application of telerehabilitation in occupational therapy practice and its clinical outcomes over the last ten years. These researchers reported that telerehabilitation offers an alternative service delivery model for occupational therapy, bridging distance and offering user-friendly treatment for patients at home. Sarsak [39] review study confirmed that telehealth is valuable and can be an appropriate remote service delivery model for occupational therapy. Little et al. [40] investigated the efficacy of occupation-based coach-

ing delivered via telehealth for 18 families of children with ASD aged 2-6 years. This study revealed that the occupation-based coaching delivered via telehealth is an effective intervention method to increase parent efficacy and child participation among families of children with ASD. Also, Najafabadi et al. [41] showed that the SPARK program significantly improved balance (static and dynamic), bilateral coordination, and social interaction in children with ASD. Little and Dunn [42] showed the effectiveness of a 12-week telehealth intervention for families of children with ASD. Gibbs and Toth-Cohen [43] applied telerehabilitation for parents to address sensory modulation in children with ASD. These study findings showed the potential for using telerehabilitation as a way to provide occupational interventions.

This study seeks to answer the research question of whether the family-based telerehabilitation of SPARK's motor program can improve the development of gross motor skills in children with ASD.

2. Materials and Methods

The research was quasi-experimental with a pretest-posttest design without a control group. This research design (without a control group) is appropriate in conditions where the goal is to change the ASD symptoms [44]. The study population included all children with high-function of ASD who were receiving services from the Autistic Spectrum Disorders Centers in 2012, under the supervision of the Iranian Welfare Organization. The inclusion criteria included not receiving any other physical and motor interventions simultaneously with this research, lacking comorbidities such as attention deficit hyperactivity disorder and other developmental disorders, not having speech and hearing deficits in parents and children, having a minimum diploma degree of education for parents, and having a phone at home. The exclusion criteria included not attending two or more sessions of the intervention.

In this research, the available sampling method was used. Therefore, after referring to the welfare organization and obtaining permission to carry out the present research, the list of the centers under the supervision of this organization was obtained. Then, three families living in Tehran, three families in Isfahan, three families in Quds, and one family in Kermanshah provinces were selected to participate in this study. However, one family left the study during the intervention, and finally, the study was completed with 9 families of children with ASD. Because access to families of children with high-functioning ASD who were interested in participating in

the study was limited, this number of children who participated in the study was small, and this research was a pilot study. We got informed consent from families.

Study questionnaire

Ulrich test of gross motor development

In this study, the test of gross motor development (TGMD-2) was used to assess children's motor skills. It is a normative test that measures gross motor skills in the range of 3 to 10 years. TGMD-2 is divided into loco-motor (including running, galloping, hopping, leaping, jumping, and sliding) and object control (including striking a stationary ball, stationary dribble, catch, kick, and overhand throw) subtests. The norm-referenced test used for the assessment of preschool children was used. The validity and reliability of this test have already been studied [45, 46]. The Persian version of this test has also been validated [47].

Study intervention

After sampling and explaining the study, by using the telephone call with all families, the items of the gross motor skills development questionnaire were read to them, and parents responded (at the end of the research and the posttest, a questionnaire was completed by telephone). Then, SPARK motor program [48, 49] sessions were taught to families daily by phone, and the parents performed the program for 24 sessions of 45 minutes in 8 weeks (3 sessions per week). During the intervention, the parents were free to contact the therapist if they had a problem, and the therapist guided them. Also, when the parents were in trouble (such as heating and cooling in the intervention program), training the movements was provided for the parents through photographs and videos, with the help of the telegram program. The summary of the intervention sessions is presented in Table 1.

3. Results

This study aimed to determine the effectiveness of family-based teleintervention of SPARK motor program intervention on the development of gross motor skills in children with ASD. To achieve this goal, the collected data from the sample group were analyzed during two stages of administration of the questionnaire (pretest and posttest). Before examining the primary analyses, we examined the descriptive indexes. In this study, 9 families of children with ASD participated. The mean (SD) age of the children was 6.33 (0.92) years. The minimum and maximum age of the participants was 4 and 8 years. Fur-

Table 1. Summary of SPARK Intervention Sessions

Sessions	Warm-up and First Part of the Session	Second Part of the Session and Cool Down
1	Warm-up, walking with heels, jumping with rotation	Throw the ball up, throw the ball into the wall, cool down
2	Warm-up, walking with heels and claws, jumping by rotation	Shot the ball to the wall, ground balls, cool down
3	Warm-up, walking on heels and paws, jumping	Throw the ball up, free drinks, cool down
4	Warm-up, frogs, jump on the rope, slow running	Hitting, hat, cool down
5	Warm-up, wolf to the air, smash, slip	Pass the hat, keep the ball in the air, cool down
6	Warm-up, jumping in rings, licking in rings	Middle, pass, dribble free, cool down
7	Warm-up, high up, jump and shake hands together	Target, ball bearings, balls, and balls, cool down
8	Warm-up, jumping over the rope, licking	Seven rocks, shuffle the ball from left to right, cool down
9	Warm-up, uncle chain, bush, vault	Bear in the middle, wolf and flock, cool down
10	Warm-up, racing with sack, rope, sweatshirt	Throw a ring, hit the ball with a baton, cool down
11	Warm-up, playing hotter mill, vault	Punch the ball to the wall, winding, cool
12	Warm-up, uncle chained, playing chopped eggs	Rope, ball between legs and above, cool
13	Warm-up, jump over two lines in pairs	Linear dribbling, moving and knocking, cool down
14	Warm-up, moving skills, parachute	Ground balls, ball to the circle, cool down
15	Warm-up, seven rocks, racing with a sack	Hitting, passing a ball by hand, cool down
16	Warm-up, jump over the line of foot and one leg	Target, play with rocket and ping pong ball, cool down
17	Warm-up, special rotation, sitting and standing	Bear in the middle, barefoot, uncle chained, cool down
18	Warm-up, jumping over the rope, in the middle	Shot the ball to the wall, pass the hat, cool down
19	Warm-up, jump over two lines in pairs	Hitting, passing a ball by hand, cool down
20	Warm-up, jump from line to foot, and one leg	Hitting, passing a ball by hand, cool down
21	Warm-up, seven rocks, racing with a sack	Ground balls, ball to the wall, cool down
22	Warm-up, uncle chained, playing chopped eggs	Shot the ball to the wall, winding, cool down
23	Warm-up, Wolf to the air, sitting and standing, Falling	Pass the hat, keep the ball in the air, cool down
24	Warm-up, slipping, walking the heel and paw	Shot the ball to the wall, ground balls, cool down

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ther, considering that the Ulrich test has two subtests of displacement and object control, each containing several items of motion, the effectiveness of the selected intervention on each of the items is presented separately. The t-test results for evaluating the significance of the difference between the pretest and the posttest on the subtest items in the Ulrich test are presented in [Table 2](#).

[Table 2](#) shows that the mean scores of participants in all subtests of gross motor skills development, except Go

lollipop in the posttest, significantly improved ($P < 0.05$). So the intervention of the SPARK motor program enhanced the skills of displacement in children with a high-functioning autism spectrum disorder.

The t-test results were also calculated for examining the difference between the pretest and posttest on the object-control subscale items in the gross motor growth test, which were reported in [Table 3](#).

Table 2. Results of the t-test for evaluating the effects of the intervention on displacement subtests of gross motor skills

Items	Mean±SD	Standard Error of Mean	Mean Difference	t	df	Sig.
Run	Pretest	4.11±1.83				
	Posttest	7.33±1.11	-3.22	-8.04	8	0.001
Go lollipop	Pretest	2.33±2.73				
	Posttest	5.33±3.60	-3.00	-1.71	8	0.12
Licking up	Pretest	3.78±3.11				
	Posttest	8.11±2.36	-4.33	-5.30	8	0.001
Jump	Pretest	1.44±2.18				
	Posttest	4.89±2.26	-3.44	-4.12	8	0.003
Jump pair	Pretest	3.67±1.22				
	Posttest	6.67±1.22	-3.00	-6.80	8	0.001
Glide	Pretest	2.56±2.87				
	Posttest	6.11±2.75	-3.55	-2.23	8	0.05

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4. Discussion

This study showed that family-based teleintervention of the SPARK motor program had improved the motor skills of children with ASD in the present study. This finding is consistent with the results of previous studies, which are based on the effectiveness of the SPARK program for children with ASD [36, 41, 48, 49]. In explaining these findings, it can be said that applying SPARK's motor intervention improves gross motor skills by increasing physical fitness [41]. Evidence suggests that children develop their motor skills in interacting with the environment and engaging in it. Our results have many similarities with Najafabadi [41] findings that showed the effectiveness of the SPARK program on balance (static and dynamic), bilateral coordination, and social interaction in children with ASD. Also, our findings are consistent with Hung and Fong's [38] review study results that suggested telerehabilitation as an alternative service delivery model for occupational therapy. These findings are in line with Sarsak [39] study that confirmed telehealth usefulness and an appropriate remote service delivery model for occupational therapy. Our study findings showed the potential for using telerehabilitation as a way to provide occupational interventions.

Integrating and sustaining appropriate motor education programs by facilitating the child's interaction with the environment increases his or her motor skills. The

results also showed no significant improvement in the skill of Go lollipop (a subtest of gross motor skills) after participation in the present study. Enhancing this skill in children with ASD likely needs more time and practice, and parents should be trained more directly.

In summary, the study results showed that the intervention improves the overall movement of children with ASD. However, exercise and motor activity are an essential part of a healthy lifestyle, and this is especially important for children with ASD, who have a low level of physical fitness and problems in developing motor skills [8-11]. SPARK motor program can be beneficial for sensory integration, coordination, muscle tone, and consequently, the improvement of the motorized motor skills of children with ASD. It is suggested that parents be considered the initial experts on their children. They spend more time with them than almost any other adult the child encounters in their day-to-day lifetime [50]. However, it is essential to note that parents of children with ASD symptoms may need the interventions because of the high stress they experience [51-56], and involving these parents in interventions for their children can reduce their stress and enhance their mental health [57, 58]. The exercise program for these children must be steady and produce lasting effects such as strength and flexibility, so the intensity and duration of exercise should gradually increase. On the other hand, since parents are familiar with their children, motor skills training

Table 3. Results of t-test, evaluating the effects of the intervention on object-control subtests of gross motor skills

Items		Mean±SD	Standard Error of Mean	Mean Difference	t	df	Sig.
Shot the ball with the baton	Pretest	2.44±1.23	0.41	-4.22	-4.06	8	0.004
	Posttest	6.67±2.91	0.97				
Dribble inside	Pretest	1.56±2.007	0.66	-2.33	-2.40	8	0.04
	Posttest	3.89±2.66	0.88				
Get the ball	Pretest	1±0.86	.028	-2.66	-5.33	8	0.001
	Posttest	3.67±1.41	0.47				
Hit the ball with the foot	Pretest	4±1.22	0.40	-2.44	-4.21	8	0.003
	Posttest	6.44±2.12	0.70				
Throw the ball overhead	Pretest	3±1.87	0.62	-2.55	-4.82	8	0.001
	Posttest	5.56±1.01	0.33				
Rolling the ball down	Pretest	0.89±1.05	0.35	-4.11	-5.74	8	0.001
	Posttest	5±1.58	0.52				

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is provided by the child in collaboration with the parent, and doing homework is usually pleasurable and appealing to them, thereby encouraging the child to do exercises

The results of Table 3 also show that our intervention has significantly improved all items of the object-control subtest of the growth motor skills development in children with a high-functioning ASD ($P<0.05$).

Study limitation

Some limitations may probably have influenced the obtained results. The first is sampling issues. Our sample group was small, and we couldn't have a control or a waiting list group (because of the small available sample size). These issues may affect the validity of our results. The second is the assessment issues. To evaluate the children's gross motor skills, we used the parent-report questionnaire. Also, since parents were aware of the study goals, there may have had social desirability biases in completing the questionnaire.

Study implications

This study is the first step towards enhancing our understanding of effective teleinterventions to improve children with ASD gross motor skills, and our results should be validated by randomized control trials and larger sample sizes in the subsequent studies.

5. Conclusion

According to the study findings, participating in the SPARK motor program improves children's motor skills with ASD. It can be argued that family-based teleintervention can be used as an innovative and effective method by officials and policymakers of the ASD centers to provide affordable health care for children with ASD everywhere.

Ethical Considerations

Compliance with ethical guidelines

The Ethics Committee of Shahid Beheshti University, Tehran approved the study protocol (SBU.ICBS 96/1020).

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Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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