IMPROVEMENT OF THE HEALTH OF PEOPLE WITH AUTISM SPECTRUM DISORDER BY EXERCISE

MELHORIA DA SAÚDE DE PESSOAS COM TRANSTORNO DO ESPECTRO DO AUTISMO POR MEIO DE EXERCÍCIOS FÍSICOS

MEJORA DE LA SALUD DE LAS PERSONAS CON TRASTORNO DEL ESPECTRO AUTISTA MEDIANTE EL EJERCICIO FÍSICO

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ABSTRACT

Introduction: Autism Spectrum Disorder (ASD) is a typical neurological development disorder of the brain, exhibiting social communication and communication disorders, narrow interests, and repetitive, stereotyped behaviors. Movement development is an important evaluation index for the development of early motor function in children, so exercise intervention in children with ASD is of great significance. Objective: This article conducts exercise intervention on children with ASD to stimulate their exercise ability and improve their self-care ability. Methods: The article randomly grouped 24 children with an autism spectrum disorder. The experimental group received exercise intervention, and the control group had regular classes. After the experiment is completed, the influence of exercise intervention on children with autism is analyzed. Results: The motor skills of the two groups of children were different after the intervention. The motor skills of the experimental group improved more significantly. Conclusion: Exercise intervention can significantly improve the motor skills of children with an autism spectrum disorder. To evaluate whether the large-muscle motor skill learning of children with ASD and its influence on basic motor skills can be transferred to provide a reference for related motor intervention. ***Level of evidence II; Therapeutic studies - investigation of treatment results.***

Keywords: Autism Spectrum Disorder; Exercise; Motor Skills.

RESUMO

Introdução: O transtorno do espectro do autismo (TEA) é um transtorno do neurodesenvolvimento típico do cérebro, que apresenta transtornos de comunicação e comunicação social, interesses estreitos e comportamentos repetitivos e estereotipados. O desenvolvimento do movimento é um índice de avaliação importante para o desenvolvimento da função motora precoce em crianças, portanto, a intervenção com exercícios em crianças com TEA é de grande importância. Objetivo: Este artigo realiza uma intervenção de exercícios em crianças com TEA para estimular sua capacidade de exercício e melhorar sua capacidade de autocuidado. Métodos: O artigo agrupou aleatoriamente 24 crianças com transtorno do espectro do autismo. O grupo experimental recebeu intervenção de exercícios e o grupo controle teve aulas regulares. Após a conclusão do experimento, a influência da intervenção do exercício em crianças com autismo é analisada. Resultados: As habilidades motoras dos dois grupos de crianças foram diferentes após a intervenção. As habilidades motoras do grupo experimental melhoraram mais significativamente. Conclusão: A intervenção com exercícios pode melhorar significativamente as habilidades motoras de crianças com transtorno do espectro do autismo. Avaliar se a aprendizagem de grandes habilidades motoras musculares de crianças com TEA e sua influência nas habilidades motoras básicas podem ser transferidos para fornecer uma referência para a intervenção motora relacionada. ***Nível de evidência II; Estudos terapêuticos: investigação dos resultados do tratamento.***

Descritores: *Transtorno do Espectro Autista; Exercício Físico, Capacidade Motora.*

RESUMEN

Introducción: El trastorno del espectro autista (TEA) es un trastorno del desarrollo neurológico típico del cerebro, que presenta trastornos de comunicación y comunicación social, intereses estrechos y comportamientos repetitivos y estereotipados. El desarrollo del movimiento es un índice de evaluación importante para el desarrollo de la función motora temprana en los niños, por lo que la intervención con ejercicios en niños con TEA es de gran importancia. Objetivo: Este artículo realiza una intervención de ejercicio en niños con TEA para estimular su capacidad de ejercicio y mejorar su capacidad de autocuidado. Métodos: El artículo agrupó aleatoriamente a 24 niños con un trastorno del espectro autista. El grupo experimental recibió intervención con ejercicios y el grupo de control tuvo clases regulares. Una vez completado el experimento, se analiza la influencia de la intervención del ejercicio en los niños con autismo. Resultados: Las habilidades motoras de los dos grupos de niños fueron diferentes después de la intervención. Las habilidades motoras del grupo experimental mejoraron de manera

más significativa. Conclusión: La intervención con ejercicios puede mejorar significativamente las habilidades motoras de los niños con un trastorno del espectro autista. Evaluar si el aprendizaje de las habilidades motoras de los músculos grandes de los niños con TEA y su influencia en las habilidades motoras básicas se puede transferir para proporcionar una referencia para la intervención motora relacionada. ***Nivel de evidencia II; Estudios terapéuticos: investigación de los resultados del tratamiento.***

Descriptores: *Trastorno del Espectro Autista; Ejercicio Físico; Destreza Motora.*

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INTRODUCTION

Autism spectrum disorder (ASD) is a typical neurodevelopmental disorder of the brain, which exhibits social communication and communication disorders, narrow interests, and repetitive, stereotyped behaviors. Due to brain damage, children with ASD have varying motor dysfunction degrees, manifested as motor development retardation, abnormal development of large muscles, abnormal fine motor, abnormal motor performance, and poor motor coordination. Motor development is a crucial evaluation indicator for developing early motor function in children.[1]

At present, there are many intervention methods for children with ASD, such as applied behavior analysis, structured teaching (TEACCH), drug therapy, music therapy, sports intervention, etc. This study takes school-age children with ASD as the subjects and evaluates the large-muscle motor skills learning of ASD children and its impact on basic motor skills. It also explores whether the large-muscle motor skills learning can produce migration, to provide relevant exercise interventions reference.

METHOD

Research object

Based on the ASD diagnostic criteria and psychological education scale (C-PEP) in the Interview Guide for Autistic Parents (ADI-R), 24 autistic children from 3 school-age classes were randomly selected as subjects (18 boys, 6 girls). Before the experiment, the children's guardians read the recruitment letter and signed the parental informed consent.

Research design

The thesis adopts the experimental method to carry out 2 (groups: experimental group and control group) × 2 (test phase: pre-test and post-test) mixed experiments. The independent variable is the learning task: the large-muscle motor skill learning of the experimental group and the conventional motor skill learning of the control group. The dependent variable is the level of fundamental motor skills.

Research tools

In sports training, significant muscle motor skills assessment (TGMD-3) and basic motor skills assessment are primarily used as tools to evaluate the corresponding indicators of children with ASD. The large-muscle motor skills assessment is suitable for younger children with ASD who usually have severe dyskinesias in the early development stages. The horizontal displacement motor skill test score is 0~46 points, the object control motor skill score is 0~54 points, and the total score of 13 motor skills is 0~100 points. The higher the level, the higher the level of motor skills of the big muscles.

The primary motor skills assessment is called the "gold standard test" for assessing children's motor coordination and the "IQ test for motor coordination." It has been widely used to assess children's basic motor skills with ASD, including finger flexibility, object control, and physical fitness balance. Finger flexibility is evaluated by timing and measurement accuracy.

Experimental process

The whole experiment is divided into 3 phases: pre-test phase, exercise intervention phase, and post-test phase.

In the pre-test phase, all subjects received the assessment of considerable muscle motor skills and basic motor skills, first demonstrated by the teacher. Then the subjects performed the same movements for one week.

During the exercise intervention phase, the intervention time was 12 weeks, three times a week, about 60 minutes per time. The experimental group's intervention content included three parts: warm-up activities, basic movements and teaching practice, and relaxation activities.[2] First of all, during the warm-up activity stage, we make ASD children feel familiar with their teachers and peers; add auxiliary actions related to physical education courses to avoid sports injuries; after the warm-up, teachers will conduct picture explanations and action demonstrations, and subjects will imitate With group exercises and individual presentations and other different forms of transformation, it will increase the interest of the physical education curriculum and focus the attention of ASD children. (Figure 1)

The control group did the regular study, and the subjects received morning exercises, functional rehabilitation classes, music classes, art classes, or physical training. In the last week of the children's exercise intervention in the post-test phase, the two subjects were assessed again for considerable muscle motor skills and basic motor skills. The selection of locations, measurement tools, instruction language, instructors, and evaluation teachers for the pre-test and post-test of the experiment are consistent.

Data collection and analysis

We used two cameras to record the whole process of sports intervention and evaluation. Two evaluators, four observers, and five assistant teachers recorded the physical activity and sports performance of ASD children in the classroom.[3] Simultaneously, the examiner conducts interviews with teachers and parents before and after class to adjust and improve the sports intervention plan in time. We use SPSS20.0 to process

Figure 1. Throwing the ball.

and analyze relevant data. We use the update vector of the value function to iterate the data redundancy value of the hybrid cloud and carry out the iterative research of the hybrid cloud's data redundancy value.

Use Bellman redundancy to find the mean square error E of the update vector of the hybrid cloud data value function,

$$E = \sum_{x} (\Delta W - \Delta W_{\varphi})^2 \quad (1)$$

Among them, E is the mean square error of the redundant value of the hybrid cloud data, and the weight increment of the mean square error of the redundant value of the hybrid cloud data is

$$\Delta E = -\alpha \sum_{x} (\Delta W - \Delta W_{\varphi})^2 \quad (2)$$

In the formula, ΔE is the weight increment of the mean square error of the hybrid cloud data's redundant value.[4]

$$q = \varphi \frac{E[D(x)]}{W} \left[\max \langle R + \gamma V(x') \rangle - \frac{E[D(x)]}{W} \right] \quad (3)$$

To realize the iterative algorithm research of hybrid cloud data redundancy value.

RESULTS

Changes in motor skills of subjects before and after exercise intervention

The independent sample t-test results found that in the pre-test, there was no significant difference between the considerable muscle motor skills of the experimental group and the control group, indicating that before exercise intervention, the baseline levels of considerable muscle motor skills of the two groups of subjects were similar. After 12 weeks of extensive muscle motor skills intervention, the scores of 13 motor skills of the experimental group and the control group changed.[5] (Figure 2) To verify the interaction between groups and time, general linear model (GLM) two-factor repeated-measures analysis of variance was used, with time as the intra-subject factor and groups as the inter-subjects factors, analysis of the effect of the intervention on considerable muscle motor skills.

Changes in the primary motor skills of the experimental group before and after exercise intervention

We used an independent sample t-test to analyze children's basic motor skills development level with ASD before exercise intervention. The results found that in the pre-test, there was no significant difference between the basic motor skills of the experimental group and the control group, indicating that the basic motor skills of the two groups before the exercise intervention. The baseline level is similar.[6] After exercise intervention, the experimental group's basic motor skills scores and the control group showed different degrees of improvement. (Figure 3) The results showed that the subjects' fundamental motor skills had no significant differences in the main effects of time, main effects of groups, and interaction effects between time and groups.

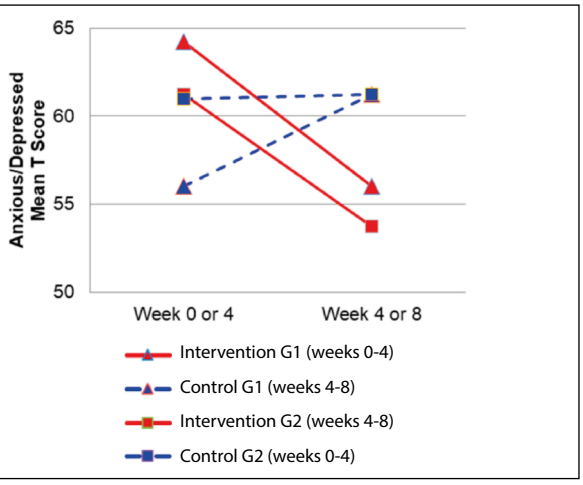

Figure 2. The trend of changes in the two groups of ASD children's motor skills before and after exercise intervention.

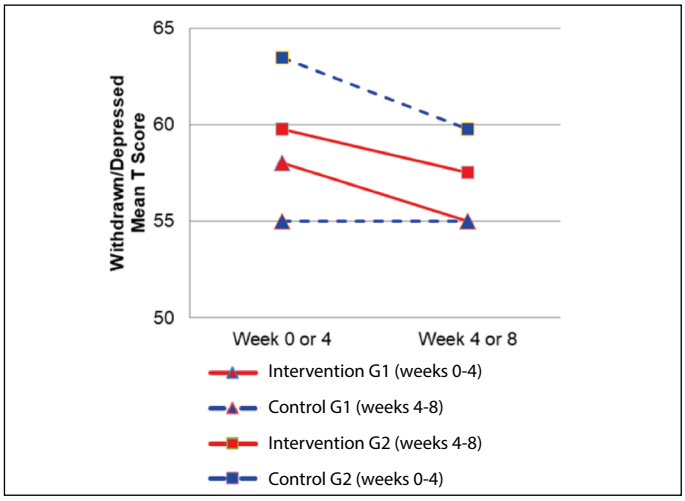

Figure 3. The changing trend of the two groups of ASD children's primary motor skill scores before and after the significant muscle exercise intervention.

DISCUSSION

The effectiveness of large-muscle motor skill intervention on children with ASD

The study results show that 12 weeks of large-muscle motor skill learning has a positive effect on ASD children. The two groups of subjects have improved their large-muscle motor skills, and the experimental group has a more significant improvement in their large-muscle motor skills. There are fewer common influencing factors between skills. Studies have found that the motor dysfunction of children with ASD does not naturally improve with age, and these abnormal motor behaviors can continue from childhood to adulthood.[7] Through the study of considerable muscle motor skills, the experimental group's object control motor skills improved more significantly, indicating that motor intervention effectively improves the motor dysfunction of children with ASD.

The influence of considerable muscle motor skills on the basic motor skills of ASD children

After 12 weeks, the basic motor skills of the ASD children in the experimental group and the control group were also developed correspondingly, but the effect was not significant. This shows that the large muscle motor skills interventions received by the experimental group and the regular motor skills learning received by the control group cannot significantly promote the basic motor skills of ASD children.

Analysis of the characteristics of movement structure of motor skills

There are fewer elements in the movement structure of large-muscle motor skills and basic motor skills. The overhand throwing of large-muscle motor skills emphasizes that the dominant holding ball swings backward and downward to the back of the body, and the ball is moved forward on the opposite side of the throwing hand. After being thrown, it directly touched the wall and did not bounce on the ground. In basic motor skills, the subject (7-10 years old) throws a ball 1.8m away from the wall and hits it. The ball hits the wall and bounces once on the ground to catch the ball and throw it.

Analysis of brain development characteristics of children with ASD

Some scholars have found that the jumping ability of children with ASD between 3 and 10 years old did not change significantly before and after the exercise intervention. The reason is that the children with ASD jumped vertically in the intervention while jumping horizontally in the jump test. They can hardly distinguish between horizontal and vertical. Children with ASD pay more attention to the current motor tasks than the processes or forms involved in performing motor skills, and their motor skills transferability is insufficient. Functional magnetic resonance imaging (fMRI) studies have found significant differences between the amygdala areas of ASD children and normal children.[8] ASD children do not show a similar inhibition process. The above studies have shown that the neural activity of the brain motor areas of ASD children is weak. The poor mobility of motor skills in children with ASD is related to abnormalities in the brain structure and development process.

Related suggestions

1) In the experimental design, strengthen the control of irrelevant variables (drug history, disease, etc.), increase the exercise intervention time, and further increase the sample size. 2) When we conduct motor skill interventions, we scientifically design learning content, increase the common action elements between motor skills, and promote motor skill transfer. Thoroughly consider the individual differences of ASD children, give timely positive feedback, provide appropriate assistance, improve their self-efficacy, attract their attention, and stimulate their interest in learning motor skills. 3) When we evaluate the effect of motor skill learning and the final assessment, we should also add formative evaluation, use the form of a portfolio, etc., to track and record the intervention effect and analyze the situation of ASD children's motor skill learning.

CONCLUSION

This study explored the effect of large-muscle motor skills learning on children's basic motor skills with ASD. The results showed that both large-muscle motor skills learning and conventional motor skills learning could effectively improve the motor movement disorders of ASD children. Compared with conventional motor skills learning, the intervention effect of considerable muscle motor skills is better. The study of considerable muscle motor skills cannot significantly promote children's basic motor skills with ASD.

All authors declare no potential conflict of interest related to this article

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REFERENCES

1. Case L, Yun J. The effect of different intervention approaches on gross motor outcomes of children with autism spectrum disorder: a meta-analysis. Adapt Phys Activ Q. 2019;36(4):501-26.
2. Ruggeri A, Dancel A, Johnson R, Sargent B. The effect of motor and physical activity intervention on motor outcomes of children with autism spectrum disorder: A systematic review. Autism. 2020;24(3):544-68.
3. Tse ACY. Brief report: impact of a physical exercise intervention on emotion regulation and behavioral functioning in children with autism spectrum disorder. J Autism Dev Disord. 2020;50(11):4191-8.
4. Elliott LK, Lloyd M. How do parents and families benefit when their child (ren) with autism participate in an early motor skill intervention. JEMS. 2019 [cited 2021 Jun 9];51(1):95-95. Available from: https://www.scapps.org/jems/index.php/1/article/view/2313
5. Elliott LK, Weiss JA, Lloyd M. Beyond the motor domain: exploring the secondary effects of a fundamental motor skill intervention for children with autism spectrum disorder. Adapt Phys Activ Q. 2021 Feb 3;38(2):195-214.
6. Xu W, Yao J, Liu W. Intervention effect of sensory integration training on the behaviors and quality of life of children with autism. Psychiatr Danub. 2019;31(3):340-6.
7. Shanok NA, Sotelo M, Hong J. Brief Report: The utility of a golf training program for individuals with autism spectrum disorder. J Autism Dev Disord. 2019;49(11):4691-7.
8. Healy S, Marchand G. The feasibility of Project CHASE: A Facebook-delivered, parent--mediated physical activity intervention for children with autism. Int J Disabil Dev Educ. 2020;67(2):225-42.