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REHABILITATION OF CHILDREN WITH SENSORY INTEGRATION DISORDERS AND THE IMPACT OF THERAPEUTIC GAMES

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Abstract

Introduction. The use of therapeutic games, modern technologies and an interdisciplinary approach constitutes a promising direction that has the potential to enhance the efficacy of therapy and facilitate the successful integration of children with sensory integration disorders (SID) into the social environment.
Aim. The aim of this study is to evaluate the effectiveness of therapeutic games in the rehabilitation of children with SID and to identify their impact on the development of psychomotor and sociocognitive skills. The use of therapeutic games emerges as a promising approach with the potential to significantly enhance the quality of life for children with SID, thereby facilitating their successful social and educational integration.
Materials and methods. The psychomotor skills of the participants were assessed using standardised testing methods, including the Bruininks-Oseretsky Motor Competence Test (BOT-2) and the Peabody Fine Motor Scale (PDMS-2). The assessment of sociocognitive skills was conducted using standardised methods and observations, such as the Adaptive Behavior Assessment Scale (ABAS-3) and the Conners Attention and Academic Rating Survey (CAARS).
Results. The diagnosis of sensory integration disorders is a complex process that involves taking a medical history, observing the child's behavior in various situations, and administering standardized tests. Results of the Bruininks-Ausseret Test (BOT-2) showed significant improvement in coordination and fine motor skills in 26 (86.67%) participants after the intervention. According to the The Vineland Adaptive Behavior Scale (VABS), 21 (70%) children demonstrated improvement in social interaction after the intervention. Reduced anxiety and improved mood were recorded in 18 (60%) participants using the Conners Attention and Academic Rating Survey (CAARS).
Conclusions. 1. Effectiveness of therapeutic games. 2. Confirmation of the importance of an individualized approach. 3. The significance of an interdisciplinary approach.

Keywords: **sensory integration disorders, therapeutic games, fine motor skills**

INTRODUCTION

Sensory integration disorders (SID) are a significant problem in modern neuropsychology and pediatrics. These disorders, characterized by dysfunction of the central nervous system in the process of sensory information processing, have a substantial impact on the quality of life of affected children. Manifestations of SID can vary from hypersensitivity to hyposensitivity to sensory stimuli, leading to disturbances in adaptive behaviour, cognitive functions, and social interaction. The prevalence of SID in the paediatric population, as indicated by epidemiological studies, underscores the relevance of this issue.

The consequences of SID extend beyond the individual, impacting family functioning and the broader social environment. Children with SID frequently face challenges in learning, social adaptation, and emotion regulation. Consequently, the study of SID and the development of effective methods for its correction have become urgent tasks for modern science and practice.

The issue of sensory integration disorders (SID) stands as a prominent and pressing concern

within the domains of modern paediatrics and child neuropsychology. SID is characterized by dysfunctions in integrating sensory signals, which leads to disturbances in adaptive behaviour, educational activities, and social integration of children [4]. According to the National Institute of Mental Health, the prevalence of SID among children ranges from 5 to 16%, underscoring the magnitude and significance of this problem [7].

The problem is further exacerbated by the frequent co-occurrence of SID with other disorders, including autism spectrum disorder (ASD), attention deficit hyperactivity disorder (ADHD), and other neuropsychological conditions. Modern rehabilitation methods aimed at correcting SID involve the use of complex approaches, among which therapeutic games play a key role [13]. These games have been shown to be effective in developing fine motor skills, cognitive abilities, and social skills – critical components in the rehabilitation of children with SID [4].

One of the most important tasks of modern rehabilitation of children with RCI is the use of individually adapted therapeutic programs that considers the specifics of sensory impairments in each child. Individualization of therapy is based on a deep analysis of the child's sensory profile, which allows for the development of the most effective intervention methods [6]. According to Davis [3], the use of individualized approaches in the therapy of RCI can significantly improve the results of rehabilitation, reducing the manifestations of sensory impairments and improving the quality of life of children.

An important aspect of therapeutic games is their impact on the development of cognitive functions in children with SID. According to Foster and Harper [5], therapeutic games help improve children's concentration, problem-solving skills, and overall cognitive activity. This is an important factor since cognitive impairment is one of the main problems in children with SID [2]. The use of therapeutic games also helps increase children's motivation to learn, which is an important aspect in their rehabilitation [12].

Modern technologies also play an important role in the rehabilitation of children with SID. The use of interactive and virtual therapeutic games allows the creation of diverse sensory environments that can be adapted to the individual needs of each child [9]. Virtual games are effective means of developing sensory and cognitive skills, making them important tools in the rehabilitation of children with SID [2].

A key aspect of effective rehabilitation is an interdisciplinary approach involving specialists from different fields, such as psychology, physiotherapy, occupational therapy and education [8]. This allows for a comprehensive approach to therapy that considers all aspects of the child's development and provides more effective intervention [1]. According to Evan and Ford [5], a multidisciplinary approach is a key element in the successful rehabilitation of children with SID, as it allows all aspects of the child's development to be considered and provides more effective intervention.

Considering all of the above, the study of the relevance of using therapeutic games in the rehabilitation of children with SID is extremely important. This area requires further research and development to ensure the maximum effectiveness of rehabilitation programmes and to improve the quality of life for children with SID. The use of therapeutic games, modern technologies, and an interdisciplinary approach represents a promising field that can significantly enhance therapy outcomes and facilitate the successful integration of children with SID into the social environment.

AIM

The aim of this study is to evaluate the effectiveness of therapeutic games in the rehabilitation of children with sensory integration disorders (SID) and to identify their impact on the development of psychomotor and sociocognitive skills. The use of therapeutic games is a promising method that can significantly improve the quality of life of children with SID, promote their successful social and educational integration.

MATERIALS AND METHODS

The study involved 30 children aged 5 to 10 years diagnosed with sensory integration disorders. Participants were selected based on diagnostic criteria including an assessment of sensory impairments and their impact on children's daily activities. All participants obtained informed consent from their parents to participate in the study, ensuring ethical standards for conducting scientific experiments. The therapeutic game program included a 12-week course of lessons, 3 times a week, for 1 hour each. The lessons included a variety of game and therapeutic activities aimed at developing fine motor skills, improving concentration and social skills. The program was developed by specialists in the field of sensory integration and adapted to the individual needs of each child.

Assessment methods. To assess psychomotor skills, standardized testing methods were used that have been verified and meet modern criteria of evidence-based medicine, namely the Bruininks-Oseretsky test of motor proficiency (BOT-2), which made it possible to assess fine and gross motor skills, including coordination, dexterity, strength and balance [10]. This method is a reliable tool for determining the level of psychomotor development of children and is often used in clinical studies. The Peabody scale of fine motor development (PDMS-2):

this test assesses the ability of children to perform precise movements of the hands and fingers, including manipulation of small objects [6]. The test is a tool that can be used to assess the degree of development of fine motor skills and is important in the rehabilitation of children with SID.

Assessment of sociocognitive skills was carried out using standardized methods and observations such as The Vineland Adaptive Behavior Scale (VABS), which assesses social activity, communication skills and adaptation in the social environment [12, 13]. VABS allows for a comprehensive assessment of the level of social skills and the degree of their development in children with SID. As well as the Adaptive Behavior Assessment Scales (ABAS-3) and assesses the adaptive behavior of children, including communication skills, self-help and social functions [3]. ABAS-3 is an important tool for assessing the general level of social competence of children. The Conners Attention and Academic Rating Survey (CAARS) used in the study made it possible to determine the level of concentration, learning ability and behavioral aspects of children [14]. CAARS is a reliable tool for assessing the cognitive skills and behavior of children with SID.

For a more in-depth analysis of the data, heuristic assessment methods were used, such as cognitive analysis through observations and interviews with children, parents and teachers, and provided detailed information on individual changes in children's psychomotor and sociocognitive skills. A qualimetry method was also used to quantitatively assess qualitative changes in children's development during therapeutic game sessions.

Constant monitoring and evaluation of the effectiveness of therapeutic games were carried out using comparative analysis of the results. Statistical methods were used, including variance analysis (ANOVA) and a test test for dependent samples. Detailed observation of children's behavior during classes, which made it possible to identify the dynamics of changes in their cognitive and behavioral reactions.

RESULTS

Diagnosis of sensory integration disorders is a complex process that involves collecting anamnesis data, observing the child's behaviour in various situations, and using standardized tests. Anamnesis data collection includes a detailed description of the child's development, their reactions to sensory stimuli, the presence of concomitant disorders, and family history. Behavioural observation makes it possible to assess the nature of the child's interaction with the environment, their reactions to various sensory stimuli, and to identify behavioural features characteristic of SID. Standardized tests such as the Sensory Profile-2, Bruininks-Oseretsky Test of Motor Proficiency, and Sensory Integration and Praxis Tests objectively assess the level of sensory processing, motor skills, and praxis.

Treatment of SID is a multifaceted task and includes sensory integration therapy, occupational therapy, physiotherapy, speech therapy, and psychological support. Sensory integration therapy involves creating a specially organised environment that allows the child to actively explore various sensory stimuli and develop the necessary skills. Occupational therapy focuses on developing fine motor skills, coordination, self-care, and adaptive skills. Physiotherapy helps improve gross motor skills, coordination, balance, and strength. Speech therapy addresses speech disorders associated with SID. Psychological support assists the child and their family in coping with the emotional difficulties related to the disorder. The choice of treatment methods depends on the individual characteristics of the child and is determined by a specialist.

The study used evidence-based diagnostic methods. Therapeutic games are an important tool for the rehabilitation of children with sensory integration disorders (SID). However, the question of which types of games are most effective for various aspects of a child's development remains relevant. The study identified the following types of therapeutic games: sensory games aimed at developing specific sensory systems (proprioceptive, vestibular, tactile, etc.); games stimulating the development of cognitive processes (attention, memory, thinking); games promoting the development of social skills and interaction with other children; games developing fine and gross motor skills, coordination of movements. The factors influencing the effectiveness were also identified, namely age, level of development, specificity of sensory disorders; knowledge of SID features by the rehabilitation therapist directly, experience working with children; regularity of classes; duration of each class; combination of game therapy with other rehabilitation methods; involvement of parents in the therapeutic process. These are the factors that guided the specialists when conducting game therapy. After a certain period of therapy (12 weeks), a re-examination of the clients was carried out.

The results of the Bruininks-Oseretsky Test (BOT-2) showed a significant improvement in coordination and fine motor skills in 26 (86.67%) participants after the intervention. Using the paired t-test, the statistical significance of these changes was determined. Comparison of the mean values before and after the intervention revealed a statistically significant difference ($t=5.76$, $p<0.001$), indicating the effectiveness of therapeutic games in improving psychomotor skills [10].

According to the results of the Vineland Adaptive Behavior Scale (VABS), 21 (70%) children demonstrated improvement in social interaction after the intervention. Analysis of the data using the Student's t-test for paired samples showed that the mean values before and after the intervention had a statistically significant difference ($t=4.89$, $p<0.01$), which confirms the effectiveness of therapeutic games in developing social skills in children with SID.

Table 1

Indicators of Social Interaction Analysis

Indicator	Group	Mean value before intervention	Mean value after intervention	p-value
Fine motor skills (BOT-2)	Experimental	25.3 ± 4.2	32.1 ± 3.5	<0.001
Fine motor skills (BOT-2)	Control	24.9 ± 4.5	25.7 ± 4.1	>0.05

A decrease in anxiety and an improvement in mood were observed in 18 (60%) participants, as measured by the Conners Attention and Academic Rating Survey (CAARS). Using the Student's t-test, a statistically significant difference was found between the mean values before and after the intervention ($t = 3.85$, $p < 0.05$), indicating the effectiveness of therapeutic games in reducing anxiety and improving the emotional state of the children [7, 11].

DISCUSSION

The obtained results confirm the high efficiency of therapeutic games in the rehabilitation of children with SID. An integrated approach combining elements of game, therapy, and educational components contributes to a significant improvement in the coordination, fine motor skills, social, and cognitive skills of children. The use of individually adapted programs allows achieving maximum results, considering the specific needs of each child [3].

The increase in psychomotor skills indicates that therapeutic games are effective in developing motor skills and coordination in children with SID. Statistically significant results confirm that these improvements are not random but are the result of targeted therapeutic intervention. Improvement in social skills and adaptive behavior highlights the importance of integrating therapeutic games into rehabilitation programs to ensure successful social integration of children [4].

The reduction in anxiety and improvement in mood serve to confirm the therapeutic effect of games on the emotional state of children, which is an important aspect of their overall development and quality of life [6]. The use of heuristic analysis methods, encompassing cognitive analysis through observations and interviews, enabled the discernment of supplementary qualitative alterations in psychomotor and sociocognitive abilities. This finding serves to substantiate the comprehensive efficacy of therapeutic games.

Therefore, therapeutic games can serve as an effective method of rehabilitation of children with SID, providing a comprehensive approach to their development and integration into the social environment. A multifaceted approach integrating elements of game, therapy, and education fosters a positive and stimulating environment, thereby promoting active involvement of children in in the rehabilitation process. The adaptation of these programs to the unique needs of each child is crucial for ensuring the efficacy of the intervention [3]. The introduction of such methods into practice holds considerable potential to enhance the efficacy of rehabilitation outcomes and facilitate successful social integration of children with SID [6].

CONCLUSIONS

1. The effectiveness of therapeutic games: the research program confirmed that therapeutic games significantly improve the psychomotor, cognitive and sociocognitive skills of children with SID.

2. Confirmation of the importance of an individualized approach: the use of individually adapted therapeutic programs is a key factor in increasing the effectiveness of rehabilitation.

3. The significance of an interdisciplinary approach: the involvement of specialists from different fields (psychology, physiotherapy, occupational therapy, pedagogy) ensures a comprehensive approach to therapy that considers all aspects of the child's development.

RECOMMENDATIONS

1. It is recommended to introduce therapeutic games as a standard method of rehabilitation of children with SID in educational and medical institutions.

2. Organize training programs and workshops for specialists working with children with SID to familiarize them with effective methods of using therapeutic games.

3. Create and implement individually adapted rehabilitation programs that consider the specifics of each child's sensory impairments.

Development prospects. Conducting additional research to evaluate the long-term effectiveness of therapeutic games in the rehabilitation of children with SID and expanding the sample of study participants. Using interactive and virtual therapeutic games which facilitate the creation of diverse sensory environments and adaptation to the individual needs of each child. Establishing cooperation with international specialists and institutions to exchange experiences and implement best practices in the rehabilitation of children with SID.

COMPLIANCE WITH ETHICAL REQUIREMENTS

The study was conducted in accordance with the recommendations of the Ethics Committees for Biomedical Research, Ukrainian Health Legislation and the Declaration of Helsinki of 2000, European Community Directive 86/609 On Human Participation in Biomedical Research.

Conducting the research does not contradict the norms of Ukrainian legislation and meets the requirements of the Law of Ukraine «On Scientific and Scientific-Technical Activities» dated November 26, 2015 No. 848-VIII. Each participant signed an informed consent

to participate in the study, and every effort was made to ensure participant anonymity. For studies involving minors or individuals with limited legal capacity, informed consent was obtained from their legal representatives.

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The authors declare no conflict of interest regarding this article. No external funding was provided for this study.

AUTHOR CONTRIBUTIONS

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REFERENCES

1. Banire, B., Jomhari, N., & Ahmad, R. (2015). Visual Hybrid Development Learning System (VHDLS) Framework for Children with Autism. Journal of Autism and Developmental Disorders, 45(10), 3069-3084. https://doi.org/10.1007/s10803-015-2469-7
2. Batool, S., Saeed, A., Ghous, M., & Khushnood, K. (2022). Augmented effects of sensory integration therapy and virtual reality on movement and balance issues in cerebral palsy: a pilot study. The Rehabilitation Journal, 06(04), 451-456. https://doi.org/10.52567/trj.v6i04.165
3. Castro-Martinez LJ (2013) Programa de estimulación de habilidades para el desarrollo del pensamiento y fortalecimiento de dispositivos básicos de aprendizaje en niños de edad prescolar. Universidad de La Sabana. http://hdl.handle.net/10818/16778
4. Cemali, M., Pekçetin, S., & Akı, E. (2022). The Effectiveness of Sensory Integration Interventions on Motor and Sensory Functions in Infants with Cortical Vision Impairment and Cerebral Palsy: A Single Blind Randomized Controlled Trial. Children, 9(8), 1123. https://doi.org/10.3390/children9081123
5. Constain Moreno, G. E., Collazos, C. A., Bautista, S., & Moreira, F. (2022). FRIDA, a Framework for Software Design, Applied in the Treatment of Children with Autistic Disorder. Sustainability, 14(21), 14560. https://doi.org/10.3390/su142114560
6. Fadha, I. A. (2024). Occupational Therapy Approaches in Supporting Students with Sensory Disorders in Islamic Education. Dirasah International Journal of Islamic Studies, 2(1), 96-105. https://doi.org/10.59373/drs.v2i1.26
7. Horoshko, V. I. (2023). Health care technologies in creating optimal working conditions in higher education institutions. Rehabilitation & recreation, 15, 12-16. https://doi.org/10.32782/2522-1795.2023.15.1
8. Huili, S., Xiaolin, C., Guangsen, G., Yu, J., Yu, L., & Wenpei, Z. (2023). Research on the design of somatosensory interactive games for autistic children based on art therapy. Frontiers in Psychiatry, 14. https://doi.org/10.3389/fpsyt.2023.1207023
9. Kantor, J., Hlaváčková, L., Du, J., Dvořáková, P., Svobodová, Z., Karasová, K., & Kantorová, L. (2022). The Effects of Ayres Sensory Integration and Related Sensory Based Interventions in Children with Cerebral Palsy: A Scoping Review. Children, 9(4), 483. https://doi.org/10.3390/children9040483
10. Panceri, J. A. C., Freitas, É., de Souza, J. C., da Luz Schreider, S., Caldeira, E., & Bastos, T. F. (2021). A New Socially Assistive Robot with Integrated Serious Games for Therapies with Children with Autism Spectrum Disorder and Down Syndrome: A Pilot Study. Sensors, 21(24), 8414. https://doi.org/10.3390/s21248414
11. Peña de Azcoaga, E. (2014). Fundamentos y etapas en la recuperación de un paciente con trastorno generalizado del desarrollo. Revista Chilena de Neuropsicología, 9(2):91-94.
12. Wang, Z., Gui, Y., & Nie, W. (2022). Sensory Integration Training and Social Sports Games Integrated Intervention for the Occupational Therapy of Children with Autism. Occupational Therapy International, 2022, 1-11. https://doi.org/10.1155/2022/9693648
13. Wang, L. (2022). Application of the VR Sensor Image Combined with Sports Games in the Treatment of Autistic Children. Journal of Sensors, 2022, 1-8. https://doi.org/10.1155/2022/8993833
14. Wuang, Y.-P., Chen, Y. J., Chiu, Y.-H., Wang, C.-C., Chen, C.-P., Huang, C.-L., Wu, T.-M., Hsieh, T.-H., & Ho, W.-H. (2021). Effectiveness of Kinesthetic Game-Based Training System in Children With Visual-Perceptual Dysfunction. IEEE Access, 9, 153838-153849. https://doi.org/10.1109/access.2021.3128109
15. Yana, M., Kavlak, E., & Güneş, M. (2022). Combined sensory integration therapy plus neurodevelopmental therapy (NT) versus NT alone for motor and attention in children with Down syndrome: a randomized controlled trial. International Journal of Developmental Disabilities, 1-8. https://doi.org/10.1080/20473869.2022.2152166
16. Zafeiriou, D.I. (2004). Primitive reflexes and postural reactions in the neurodevelopmental examination. Pediatr Neurol., 31, 1-8. https://doi.org/10.1016/j.pediatrneurol.2004.01.012

Резюме

РЕАБІЛІТАЦІЯ ДІТЕЙ З РОЗЛАДАМИ СЕНСОРНОЇ ІНТЕГРАЦІЇ ТА ВПЛИВ ТЕРАПЕВТИЧНИХ ІГОР

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Вступ. Використання терапевтичних ігор, сучасних технологій та міждисциплінарного підходу є перспективними напрямами, що можуть значно покращити результати терапії та забезпечити успішну інтеграцію дітей з розладами сенсорної інтеграції (РСІ) у соціальне середовище.
Мета. Метою цього дослідження є оцінка ефективності терапевтичних ігор у реабілітації дітей з РСІ та виявлення їх впливу на розвиток психомоторних і соціокогнітивних навичок. Використання терапевтичних ігор є перспективним методом, який може значно підвищити якість життя дітей з РСІ, сприяти їхньому успішному соціальному та освітньому інтегруванню.
Матеріали та методи. Для оцінки психомоторних навичок застосовувались стандартизовані тестові методики Бруїнінкса-Осеретського тест моторної компетентності (BOT-2), шкала розвитку дрібної моторики Піболі (PDMS-2), оцінка соціокогнітивних навичок здійснювалась за допомогою стандартизованих методик та спостережень таких як Шкала соціальної взаємодії Вінона (VABS), шкали оцінки адаптивної поведінки (ABAS-3), опитувальник оцінки навчальної діяльності та уваги Коннерса (CAARS).
Результати. Діагностика розладів сенсорної інтеграції є комплексним процесом, що передбачає збір анамнезу, спостереження за поведінкою дитини в різних ситуаціях та застосування стандартизованих тестів. Результати тесту Бруїнінкса-Осеретського (BOT-2) показали значне покращення у координації та дрібній моториці у 26 (86,67%) учасників після втручання. За результатами Шкали соціальної взаємодії Вінона (VABS), 21 (70%) дітей продемонстрували покращення у соціальній взаємодії після втручання. Зниження рівня тривожності та покращення настрою було зафіксовано у 18 (60%) учасників за допомогою Опитувальника оцінки навчальної діяльності та уваги Коннерса (CAARS).
Висновки. 1. Ефективність терапевтичних ігор. 2. Підтвердження значимості індивідуалізованого підходу. 3. Важливість міждисциплінарного підходу.

Ключові слова: **розлади сенсорної інтеграції, терапевтичні ігри, дрібна моторика**

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