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REVIEW ARTICLE

FORMS OF REHABILITATION OF A CHILD WITH AUTISM DESCRIBED IN MODERN MEDICAL LITERATURE

FORMY REHABILITACJI DZIECKA Z AUTYZMEM OPISYWANE WE WSPÓŁCZESNYM PIŚMIENNICTWIE MEDYCZNYM

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ABSTRACT

Introduction

Autism is a complex neurodevelopmental disorder with unknown etiopathogenesis. The clinical picture of every child with autism is different. The spectrum of symptoms includes a number of characteristic features that the patient manifests. Patients often have the problem of coexisting disorders. Difficulties in communication often make it difficult to diagnose. Hence the strictly individualized rehabilitation program, which should be tailored to the needs and preferences of the patient. Effective therapy should be carried out, taking into account the patient's motivation and pleasure.

Aim

A systematic review of publications for the most commonly used therapies in the rehabilitation of patients with autism and their effectiveness confirmed scientifically.

Material and methods

A review of the literature on the PubMed search engine has been made since 2000. Search terms used: 'autism', 'ASD', 'therapy', 'physiotherapy', 'rehabilitation'.

Results

Among the articles found in the PubMed search after entering keywords, it can be stated that the majority of publications concerned alternative medicine, especially animal therapy. Others have also appeared, e.g. manual therapy, martial arts, acupuncture, choreotherapy or music therapy.

Conclusions

Children with autism spectrum disorders require constant rehabilitation. The form it takes depends individually on the patient's current state. The chosen therapy may affect one deficit aspect of the child, but not improve another, for which the next treatment is required to improve. Analysis of the publication, however, indicates the positive impact of rehabilitation in children with autism.

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STRESZCZENIE

Wprowadzenie

Autyzm jest złożonym zaburzeniem neurorozwojowym o niepoznanej etiopatogenezie. Kliniczny obraz każdego dziecka z autyzmem jest inny. Spektrum objawów obejmuje szereg charakterystycznych cech, jakie przejawia pacjent. U chorych często obserwuje się problem występowania zaburzeń współistniejących. Trudność w komunikacji nierzadko utrudnia ich zdiagnozowanie. Stąd ściśle zindywidualizowany program rehabilitacji, który powinien być dostosowany do potrzeb, ale i również preferencji chorego. Terapia, która ma odnieść skutek powinna być przeprowadzona z uwzględnieniem motywacji oraz przyjemności dla pacjenta.

Cel

Systematyczny przegląd publikacji pod kątem najczęściej stosowanych terapii w rehabilitacji pacjenta z autyzmem oraz ich skuteczność potwierdzona naukowo.

Materiał i metody

Dokonano przeglądu piśmiennictwa w wyszukiwarce internetowej PubMed od roku 2000. Hasła użyte do wyszukiwania: 'autism', 'ASD', 'therapy', 'physiotherapy', 'rehabilitation'.

Wyniki

Wśród artykułów znalezionych w wyszukiwarce PubMed po wpisaniu słów kluczowych można stwierdzić, że najwięcej publikacji dotyczyło medycyny alternatywnej, szczególnie terapii z wykorzystaniem zwierząt. Pojawiły się również inne, tj. np. terapia manualna, sztuki walki, akupunktura, choreoterapia czy muzykoterapia.

Wnioski

Dzieci z zaburzeniami ze spektrum autyzmu wymagają stałej rehabilitacji. Forma jaką ona przybierze zależy indywidualnie od aktualnego stanu chorego. Wybrana terapia może wpływać na jeden aspekt deficytowy u dziecka, ale nie poprawiać innego, do którego poprawy wymagane jest zastosowanie kolejnej terapii. Analiza publikacji wskazuje jednak na pozytywny wpływ rehabilitacji u dzieci z autyzmem.

Słowa kluczowe: Autyzm, ASD, terapia, fizjoterapia, rehabilitacja

Introduction

Autism (Autism Spectrum Disorder, ASD) is defined as a neurodevelopmental disorder that is characterized by deficits in the social area, communication problems, and the occurrence of stereotypical, repetitive behaviours (Shen *et al.* 2019).

Epidemiology

Statistics show that 1/54 children in the US have autism (Maenner *et al.* 2016). In Poland, these data are only estimated, reaching 200.000 people, which means 1/190 children. The United Nations (UN) reports that prevalence in Europe is estimated at 1/160 children (Qun Fang *et al.* 2019). Over the years, this number has been growing. The upward trend is a disturbing phenomenon, hence the growing interest in autism in the world of science.

Etiopathogenesis

The ethology and pathogenesis of autism are unknown. A review of the literature has

not provided conclusive information on the complexity of this disorder. Research on the causes and mechanisms of autism is being conducted around the world. The genetic and environmental background is indicated (Chaste, Leboyed 2012). Biological, immune and psychosocial factors also deserve attention. It is highly probable that all of them at the same time can affect the person developing an autism spectrum disorder (Bahmani *et al.* 2016). There is also a division of potential causes into prenatal (e.g. parental age, race, antenatal haemorrhage, a threat to pregnancy, gestational diabetes), perinatal (e.g. gestational age less than or equal to 36 weeks, caesarean section, induced delivery, adverse delivery child), as well as postpartum (including low birth weight, male sex, postpartum haemorrhage) (Wang *et al.* 2017).

Diagnostics

Diagnostics of neurodevelopmental disorders from the spectrum marked by ICD-10 with the F84.0 code for child autism is a complicated, tedious process. The problem is due to the variety of symptoms that can appear at different times and with varying intensity in each patient. Symptoms are manifested in a variety of ways. Only interdisciplinary teams of specialists can undertake such a difficult task. They are based on standardized diagnostic criteria in accordance with DSM-V. This is a classification of mental disorders proposed by the American Psychiatric Association. It includes social and communication deficits (verbal and non-verbal), stereotypical and schematic behaviour, a narrowed area of interest and sensory over responsive or under responsive (Rynkiewicz, Kulik 2013). The final diagnosis is the result of observations, measurements, tests and analyses (Winczura 2019). About 80% of parents notice disturbing symptoms when the child is two years old, 30–50% notice irregularities before the age of one. On average, 24 months pass from seeing the first symptoms to make the diagnosis (Rynkiewicz 2013). It has been estimated that parents usually report to a specialist's office when the child reaches 19 months of age. Early diagnosis enables implementation at an early stage of therapy, which results in a better prognosis. The introduction of targeted therapy for work on deficit areas also improves the quality of life from the earliest months or years (Shreya *et al.* 2014).

Clinical picture

'Spectrum' – this concept reflects the complexity and diversity of the described disorder. It covers all symptoms and clinical picture of the patient. The level of their intensity can be completely different (Paglia 2020). Autism in patients manifests itself in disorders in the social area, difficult for both verbal and non-verbal contact, as well as emerging stereotypical behaviours (Winczura 2019). The functioning of people with autism spectrum disorders is not natural. Patients face many difficulties. As many as 86.9% of children are at risk of mobility impairment. Unfortunately, the percentage of people using the help of a physiotherapist, for this reason, is much lower and amounts to 31.6% (Bhat 2020). Insomnia is another challenge for these people – 44–86% of children have sleeping problems. This is a considerable difficulty, because sleep is a time of recovery, and its lack may result in the intensification of abnormal behaviour during the day (Wintler *et al.* 2020). Over 80% of respondents struggle with gastrointestinal problems (Leader *et al.* 2020). Over 64% are overweight (Silva, Santos, Silva 2020). Sensory Integration (SI) disorders occur in about 90% of children, which suggests a massive demand for SI therapy (Balasco, Provenzano, Bizzi 2020). People with autism spectrum disorders sometimes suffer from a mental disorder, manifested as anxiety disorder or depression. This can affect their functioning in society (Joshi *et al.* 2013). In extreme cases, self-harming and even suicidal behaviour occurs (Oliphant, Smith, Grahame 2020). In almost 40%, the immunity is disturbed (Lai, Lombardo, Baron-Cohen 2014). Analyses have shown the possibility of premature death in children with autism compared to

neurotypical children (Hirvikoski, Mittendorfer-Rutz, Boman 2016).

Aim

The aim of the work was a systematic review of publications in terms of the most commonly used therapies in the rehabilitation of patients with autism, and their effectiveness confirmed scientifically.

Material and methods

A review of the literature on the PubMed search engine has been made since 2000. Search terms used: ASD, autism, therapy, physiotherapy, rehabilitation.

Forms of therapy

In the rehabilitation process of disabled children, including children with autism, motivation and the form of classes, that will be accessible to the patient, are very important. Acceptance of the therapeutic form of rehabilitation of the child is necessary for effective cooperation. Patient involvement later translates into positive effects of rehabilitation (Eversole *et al.* 2016).

Almost half of the children with ASD, and more specifically, 45% of subjects with autism spectrum disorders use alternative medicine and report its effectiveness. Alternative medical systems such as acupuncture have been shown to be among the most commonly used forms, but 'mind-body support agents' such as yoga (Höfer *et al.* 2019) are also used.

The following are forms of therapy for a child with autism spectrum disorders.

Results

Motion therapies

Physical activity

A review of the literature provided information on the positive impact of broadly understood physical activity on the functioning of children with autism spectrum disorders. A physiotherapist plays a significant role in this process. Education about healthy movement, as well as consultation with a qualified person is beneficial in the process of proper movement treatment (Cynthia *et al.* 2019). Targeted and planned kinesitherapy affects the well-being and health of patients. It improves motor skills but also takes into account the psychological aspect (Fessia *et al.* 2018). Physical exercises improve cognitive function in children with ASD. Research conducted on this topic indicates an overall improvement of 76% in this area, which helps in the perception of the external environment and communicating with it. This, in turn, translates into improved comfort of the child's life. It should be noted, however, that these differences are not visible to everyone to a similar extent. It is conditioned by individual factors. (Tan, Pooley, Speelman 2016). Such exercises can also have a positive effect on eliminating stereotypical behaviour. However, it is essential to adapt them to the biomechanics of stereotypes. This means that they must be carefully tailored to each patient and also carried out in a very thoughtful and planned way (Tse, Pang, Lee 2018). Further research on physical activity is suggested in people diagnosed with autism.

Sport

Children with autism spectrum disorders often have problems with excessive weight. Research shows that 64.1% of children with ASD are overweight (Silva, Santon, Silva 2020). It is therefore essential that these children participate in sporting activities, e.g. these can be prefably team sports. This will allow regulating their body weight, which may increase as a result of the effects of psychotropic drugs given to the patient. This problem may also result from gastroenterological disorders. Gastrointestinal problems occur in almost 85% of patients. Noteworthy is the restriction of gluten in the diet (Marggraff, Constantino 2018).

SPARK training

SPARK training is successful in treating children with autism spectrum disorders in improving both static and dynamic balance. It improves motor coordination and

social interactions. Through exercises, it affects various spheres. SPARK training is a proven specialist in physical education. The assumptions are based on enhancing well-being and socialization, as well as the joy felt by participants. The part devoted to health exercises consists of elements of running, jumping and aerobic dance, while the fitness part contains, e.g. aspects of football and basketball. Team games force interaction with other people, which positively affects people with ASD who often have the problem of social withdrawal (Najafabadi *et al.* 2018).

Exergaming

Exergaming – modern technology also appears among forms of therapy. It is a digital game that requires physical activity from participants. It uses techniques that track the movement of the child. The level of difficulty can be adjusted depending on the needs as well as the child's skills. The form of physical activity is also adapted to the user's preferences. Improvement of cognitive functions thanks to vibrant graphics and physical activity are the main motives/advantages of using this method in improving children with ASD. Through play, the child is in constant motion. The position is diverse, encouraging physical activity, as well as a space for exercise in a place chosen by the guardians – a private one – which can provide comfort to the child. Motor skills and the emotional sphere are not improved when using this method (Fang *et al.* 2019).

Martial arts

Implementing children in martial arts, such as MMA (Mixed Martial Arts), can positively affect the cognitive functions of this group. However, the child's age and individual preferences should be taken into account (Phung, Goldberg 2019). The impact of karate techniques on the functioning of children with autism was examined. Improvement after the implementation of this intervention appeared in the field of communication (Bahrami *et al.* 2016). In turn, Kata training reduces stereotypes. Over 42% of participants improve (Bahrami *et al.* 2012).

Animal therapy

Hippotherapy

Most scientific reports, more than 20% of searches found in PubMed after entering keywords indicate therapies with the participation of animals. Horses are the most commonly used creatures to treat people with ASD. Hippotherapy, i.e. therapy with horses is primarily about communing with the animal, regular meetings with it. It is not necessarily horse riding. Care, stroking, or feeding is already part of the rehabilitation. Children recognize that there are other living beings in the world with whom you can integrate and that can be enjoyable. Children notice therapists, open up to parents. They begin to see the outside world (Chmiel *et al.*, Kubińska, Derewiecki 2014). These exercises increase children's motivation and involvement in activities or establishing relationships. They counteract social withdrawal (Llambias *et al.* 2016). Improvement occurs in the sphere of communication, socialization, motor behaviour and adaptation. Hyperactivity is reduced (Gabreiels *et al.* 2015). Hippotherapy has positive effects in 99% of children with autism spectrum disorders. There are suggestions that therapy with horses should be performed before stressful events for the child, such as medical treatments (Yap *et al.* 2017, Scheinberg, Williams 2017). Hippotherapy triggers empathy in children (Anderson, Meints Brief 2016). However, it should be noted that this is supportive therapy and does not improve the functioning of children in every aspect (Cerino *et al.* 2016). Hippotherapy affects the social sphere; in 70% of children, improvement is visible when attending classes regularly, in 63% this improvement is maintained. The number of therapeutic sessions is proportional to the level of development in the withdrawal of children (Holm *et al.* 2014). This can be assessed, among others, using the CARS scale. This is a gradual scale for assessing child autism. The questionnaire is

completed by the researcher. It is best when the re-examination is carried out by the same specialist, and then the result will be more reliable. The CARS score improves after the third month of practising horse therapy (Kern *et al.* 2011).

Dogotherapy

Dogs' involvement in therapy (dogotherapy) is also widespread. Dogotherapy is a method supporting the rehabilitation process, especially in children requiring long-term rehabilitation, with chronic diseases (Bociarska *et al.* 2019). Dogs participating in it are trained and certified. The presence of a qualified specialist who knows the animal with whom he works is also required. Classes can take the form of playing with a dog (Animal Assisted Activity, AAA) and therapy with a four-legged animal (Animal Assisted Therapy). It also finds its application in supporting educational processes. Exercises proposed by the therapist should be adjusted to the child's age and problems. The first positive effects may appear after the first month of participation (minimum of four meetings) (Nawrocka-Rohnka 2010). Studies proving its effectiveness indicate a visible improvement in everyday functioning in the assessment of the family (Siewersten, French, Teramoto 2015). Improvement is also noticeable in the area of facial expressions and positive gestures, as well as communication (Michelotto *et al.* 2019). Studies show a close correlation between social and motor factors in patients with ASD (Bo *et al.* 2019). Dog therapy also helps to increase the child's physical fitness, and also affects social contacts. Participants show willingness to cooperate with a therapist, become more open and show more emotions. Greater trust and a sense of security can be seen in them.

Pet therapy

It is also possible to adopt and train a quadruped as a guide dog. The effectiveness of this solution is very individual, and this option should be considered for a particular child. However, overall effectiveness has been proven to improve both conflict resolution skills and enriching social contacts (Hall *et al.* 2016, Wright, Mills 2016). Parents of children with ASD report greater peace of mind for their safety, as well as relief and greater freedom from the restrictions associated with autism. It also translates into the possibility of increasing independence for children with ASD (Burgoyne *et al.* 2014).

Alternative therapies

Sensory integration therapy

Sensor processing includes receiving, organizing and interpreting information provided with the sensors – vision, hearing, touch, taste, smell, the vestibule (Radzimińska *et al.* 2015). Sensory integration came into existence in response to irregularities associated with it. It includes the assistance of motor reactions in response to stimuli that come from the external environment. The sensory integration therapy proposed by the creator – Ayres – is used in about 90% of children with ASD. Over- or under responsivity to sensory stimuli has been observed in children with ASD. SI content therapy has very high efficiency in this area. It helps in the perception of senses, as well as organizing sensory experiences, expanding the range of horizontal arousal, which can improve the quality of everyday life. For this purpose equipment, including swings or objects of various shapes and contents, is used. However, it should be remembered that every child may have disorders in a different sensor device, and the therapy is selected individually to meet the needs and deficits of the child. It is run by a certified, trained SI therapist (Kilroy *et al.* 2019, Aziz-Zadeh, Cermak 2019). Disorders of sensory integration can have a significant scope to contribute to learning difficulties (Wasilewski 2018). They affect 5 to 16% of school children and can result in inhibition of intellectual and social development (Owen *et al.* 2013). Sensory integration therapy can improve the quality of life of children with ASD. The effectiveness of this therapy in improving the sensation of

pain and tactile stimuli was studied (Riquelme *et al.* 2018, Hatem, Montoya 2018).

Craniosacral therapy

There have been reports of the effectiveness of craniosacral therapy. It is used to reduce the symptoms of autism and brings positive effects in the daily functioning of children. The goal is to mobilize connective tissues that have been reduced. The therapist gets acquainted with the rhythm of the patient's body movements. The therapy serves to deepen inflation and deflation of the brain as well as the spinal cord. This rhythm characterizes the production, movement and resorption of cerebrospinal fluid). The quality of this movement helps the therapist to determine where the restrictions are localized. There are suggestions that neurobehavioural dysfunctions may be the result of impaired cerebrospinal fluid flow. Hence the suggestions for the introduction of this form of therapy in the process of children's rehabilitation, which would help in a positive perception of the environment (Kratz *et al.* 2017, Kerr, Porter 2017).

Manual therapy

Recent research indicates the effective use of manual therapy to combat the symptoms of autism. This is one of the few forms of structural therapy (the majority is included in functional rehabilitation). It is based on manual physiotherapy or manipulation. The improvement is noticeable in all deficit areas, but up to a certain level. Soft tissue therapy, as well as myofascial release, are probably the first to have proven effectiveness in controlling all symptoms of autism, but without eliminating them. They affect skeletal muscle relaxation, stimulate muscle stretching, and affect blood and lymph circulation. Recreation involves finding a limit and then applying firm but mild pressure at a pathological site (Jungade 2020).

Yoga, choreotherapy, music therapy

Yoga, choreotherapy and music therapy based on a relaxation response are classified as alternative medicine and play an essential role in the process of improving children with ASD. Behavioral efficacy, as well as a change in the severity of some features of autism, confirm the correctness of using these methods as methods complementing therapy (Rosenblatt 2011). Yoga has a positive effect on the overall behaviour of children (Koenig *et al.* 2012, Buckley-Reen, Garg 2012). Choreotherapy affects the emotional sphere. It improves coping with emotions, as well as body control, synchronization, but also imitation and reciprocity, which is often a problem in this group of disabled children (Koehne *et al.* 2016).

Acupuncture

There are reports on the use of acupuncture in children with ASD. It turns out that this therapy can be tolerated by children and bring positive effects to the child-parent relationship. It is a non-pharmaceutical form of treatment that works well for children with autism (Warren, Rao, Paton 2017). Electro-acupuncture helps to improve self-service skills as well as language comprehension. (Wong, Chen 2010). The intellectual and sensory response and stereotype can also be improved (Chen *et al.* 2008, Wu, Wong 2008).

The assessment of the effectiveness of rehabilitation measures used in children with autism is a very complicated topic due to the characteristics of the disorder in question. Cognitive and communication deficits very often limit the possibility of objective assessment (Table 1). Nevertheless, due to the constant growth of these children, one should look for such forms of rehabilitation that will improve the prognosis and increase the likelihood of independence in adulthood.

Conclusions

Children with autism spectrum disorders require regular therapeutic interaction.

Rehabilitation has a positive effect on the functioning of children with autism and increases their quality of life.

The form of rehabilitation depends on the current state of health, pathological symptoms

Table 1. Effectiveness of therapy including the area of impact.

Form of rehabilitation	Impact area	Effectiveness	Source
Physical activity	cognitive functions, stereotypical behaviour, motor skills	about 75% of children improve	Cynthia *et al.* 2019 Fessia *et al.* 2018 Tan *et al.* 2016 Tse *et al.* 218
Sport	weight regulation	performance not confirmed (no explicit percentage data describing effectiveness)	Marggraff *et al.* 2018 Silva *et al.* 2020
Hippotherapy	social relations, communication, hyperactivity, socialization, adaptation, motor functions	about 70% of children function better when they attend hippotherapy regularly	Anderso *et al.* 2016 Cerino *et al.* 2016 Chmiel *et al.* 2014 Gabriels *et al.* 2015 Holm *et al.* 2014 Kern *et al.* 2011 Llambias *et al.* 2016 Yap *et al.* 2017
Pet Therapy	physical fitness, facial expressions, gestures, communication, trust, fear, emotions, motivation to acquire knowledge	physical fitness – about 56% communication – 54–70%	Bo *et al.* 2019 Bociarsk *et al.* 2019 Michelotto *et al.* 2019 Nawrocka-Rohnka 2010 Siewertsen 2015
Guide dog	social relations, solving the conflict, calm of guardians	efficiency not confirmed	Burgoyne *et al.* 2014 Hall *et al.* 2016
SPARK training	static and dynamic balance, motor coordination, social interactions	coordination improved from 8.3 to 33.3%	Najafabadi *et al.* 2018
Sensory integration therapy	reduction of pain reactions in response to touch	in 90% of children with ASD, SI therapy is used and produces positive results.	Kilroy *et al.* 2019 Owen *et al.* 2013 Radzimińska *et al.* 2015 Riquelme *et al.* 2018 Wasilewski 2018
Craniosacral therapy	daily functioning	efficiency not confirmed	Kratz *et al.* 2017
Exergaming	cognitive functions	efficiency not confirmed	Fang *et al.* 2019
Martial arts	cognitive functions communication, stereotypical behaviour	over 40% of children practising martial arts perform better compared to children who did not participate in classes	Bahrami *et al.* 2016 Bahrami *et al.* 2012 Phung *et al.* 2019
Manual therapy	improvement in all deficit areas	efficiency not confirmed	Jungade 2020
Yoga, choreotherapy, music therapy	behavioral range, emotional sphere, body control synchronization, imitation and reciprocity	efficiency not confirmed	Koehne *et al.* 2016 Koenig 2012 Rosenblatt 2011
Acupuncture	child-parent relationship, self-care, language comprehension intellect, sensory reactions stereotypies	efficiency not confirmed	Chen *et al.* 2008 Warren *et al.* 2017 Wong *et al.* 2010

presented by a person with ASD and the child's preferences.

Each child with ASD presents different symptoms with varying severity, which is why therapy should be selected individually, targeted at deficit areas.

Therapy for every child with autism can affect to a different extend. In addition, it can affect one aspect without visible improvement in another area. Then additional rehabilitation measures are required.

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