

Occupational therapy for children with attention deficit hyperactivity disorder: A literature review

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Attention Deficit Hyperactivity Disorder (ADHD) remains one of the most common neurodevelopmental disorders, with prevalence reaching 5%-9% in school age children and 60%-63% of the disorder will persist to adolescent and adult. Symptoms of attention deficit, hyperactivity, and impulsivity are the hallmark of this disorder. In adult, ADHD causes social interaction dysfunction, academic problem, problem in maintaining work, problem in finishing task, problem in maintaining relationship, and poor impulse control so they are prone to anti-social behavior and drug or alcohol abuse. Comprehensive management of ADHD in childhood is urgently needed. The effectiveness of pharmacotherapy, as the standard therapy for ADHD beside behavioral therapy and psychoeducation, is hindered its side effects. One of

the proposed supporting therapies for children with ADHD is occupational therapy, a field which focuses in optimization of health and human potential through the use of occupation or activity. Some of the therapeutic methods in this field include sensory integration therapy, rhythmic therapy, occupational group therapy, cognitive-functional intervention and physical activity. Each of the methods are supported by sound theoretical basis, therefore consideration has to be made as a part of standard ADHD management..

Key Words: Attention deficit hyperactivity disorder; Occupational therapy

Abbreviations: ADHD: Attention Deficit Hyperactivity Disorder; DSM: Diagnostic Statistic Manual; dACC: Dorsal Anterior Cingulate Cortex; DLPFC: Dorsolateral Prefrontal Cortex; OFC: Orbitofrontal Cortex; PFC: Prefrontal Cortex; SMD: Sensory Modulation Disorder; SBMD: Sensory-based Motor Disorder; SDD: Sensory Discrimination Disorder

INTRODUCTION

Attention Deficit Hyperactivity Disorder (ADHD) is one of the most common neurodevelopmental disorders in children with prevalence reaching 5-9% in school-age children [1,2]. An adult with ADHD often struggle with the problem of disorganization, irritability, and sleep disturbance [3], therefore comprehensive and continuous management of ADHD is essential. The main therapeutic management of ADHD consists of pharmacotherapy and behavioural therapy which are shown to be effective [1]. However, the use of this medicine to control symptoms of ADHD sometimes face refusal from parents due to its side effects including appetite disturbance and growth retardation [4].

Occupational therapy has been proposed as one of supporting therapies which are proven to be beneficial for the management of ADHD [1]. The objective of this paper is to review occupational therapy methods for children with ADHD. It is essential for a psychiatrist to have a broad knowledge in supporting therapy options for ADHD, especially occupational therapy, to be able to integrate them into comprehensive management.

LITERATURE REVIEW

Methods for selection of studies

In this study, we collected publications by using the Google Scholar search engine using keywords Attention Deficit Hyperactivity Disorder and occupational therapy. From the search result, we included relevant studies focusing on clinical trial and case study of therapeutic methods. We also reviewed proposed occupational therapy methods for ADHD from occupational therapy textbook [5-10].

Attention deficit hyperactivity disorder

ADHD is a neurodevelopmental disorder characterized by a disturbance in focusing attention, hyperactivity, and impulsivity. Diagnostic criteria of ADHD are based on Diagnostic Statistic Manual 5th Edition (DSM-5) which consists of various sign and symptoms as a manifestation of attention deficit or hyperactivity/impulsivity or combination of both [11]. Manifestations of attention deficit include a lack of attention of details, short attention

span, forgetfulness, got distracted easily and careless. The manifestation of hyperactivity includes increased movement in a situation that requires the person to stay still while the manifestation of impulsivity includes impulsive and intrusive action [12]. To be diagnosed with ADHD, the symptoms must appear on age 12 years old and must be apparent in two environments, for example, home and school [11].

There is no single causal factor for ADHD; in fact, the occurrence of ADHD is related to a combination of genetic predisposition and environmental influence. Several known factors related to ADHD are prenatal toxic exposure, prematurity, and mechanical prenatal disturbance. This combination of factors is believed to cause a malfunction in brain circuits that play roles in information processing including dorsal anterior cingulate cortex (dACC), dorsolateral prefrontal cortex (DLPFC), orbitofrontal cortex (OFC), and prefrontal cortex (PFC) [4].

Pharmacotherapy remains as a standard treatment for ADHD besides behavioural therapy [13], however, its inherent side effects hinder the patient's compliance in consuming the drug (Figure 1).

Occupational therapy methods for ADHD



Figure 1) A variety of tools and instruments used in sensory integration therapy in Dr. Soetomo General Hospital/Faculty of Medicine Airlangga University

Occupational therapy is an allied health profession focusing on activity as a means of therapy to improve functional activity [5]. There are numerous therapeutic methods recommended for ADHD based on occupational therapy principles, which include sensory integration therapy, occupational group therapy, rhythmic therapy, cognitive-functional intervention and physical activity.

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Sensory integration therapy

Sensory integration is a theory which emphasizes the influence of sensory input processing toward human function and development [8]. Sensory integration is defined as a process to recognize, modulate, and differentiate sensation from the sensory system in order to produce targeted adaptive behavior. Sensory integration occurs since birth and provides a basis for an adaptive response which enables development of complex skill such as calculation, language, and emotional control. Disturbance in sensory integration, or sensory processing disorder, can cause a person unable to efficiently process sensory input and produce appropriate action [9].

Miller et al. [14] classify sensory processing disorder into three types: Sensory Modulation Disorder (SMD) (i.e. problem in modulating sensory input), Sensory-based Motor Disorder (SBMD) (problem in motor performance related with sensory input), and Sensory Discrimination Disorder (SDD) (problem in discriminating sensory input). Symptoms of ADHD are thought to be caused by sensory processing disorder, specifically sensory modulation disorder. Normally, sensory inputs are modulated in the brain by means of facilitation and inhibition so that the brain can perceive the sensory input at an appropriate level and respond to them accordingly. Failure in modulating the sensory input in the brain make children with ADHD unable to focus their attention, try to seek sensory input persistently, and unable to withhold respond. Sensory modulation disorder is further classified into sensory seeking type, sensory under responsive type, and sensory over responsive type.

In order to improve sensory integration and sensory processing disorder, sensory integration therapy is established by Anna Jean Ayres. Sensory integration therapy is based on five basic assumptions; they are neuroplasticity, neural organization, adaptive response, and inner drive. Activities in sensory integration therapy primarily provide stimulation for tactile, vestibular, and proprioceptive input which is considered essential for a person to interact effectively to his or her surrounding environment [15]. The main elements of sensory integration therapy consist of sensory stimulation, "just right" challenge, cooperation in choosing an activity, independent organization guidance, optimal stimulation support, play context creation, success optimization, physical safety, environment arrangement, and togetherness facilitation.

Sensory integration therapy is initiated with the assessment of sensory profile to identify the type of sensory processing disorder in a child with ADHD. Based on the sensory profile, the therapist and child decide activities that the child will do during sensory integration program. In each proposed activities, the therapist considers how it will help with the sensory processing disorder that the child has, what level of activities that the child need, and how the activities need to be modified to ensure that it provides appropriate sensory stimulation for the child [16].

The tools and instruments used in sensory integration therapy are classified into four categories: tactile tools (e.g. texture mat, brush, pillow), non-suspended moving equipment (e.g. balls in different sizes, scooter board, trampoline, drum), suspended moving equipment (e.g. stairs, hammock, sling bed) and motor planning tools (e.g. various toys and games) [15].

Rhythmic therapy

Proponents of rhythmic therapy believe that children with ADHD have a problem in the organization of motor function, especially in the timing of motor movement. The ability to arrange timing and rhythmicity of movement is considered important in various behavior's, such as movement planning, sequencing of action, and cognitive function including focusing attention and academic performance. Furthermore, it is believed that rhythmic therapy can stimulate natural brain ability to rewire its connection in the form of neuroplasticity. Therefore, specific training that addresses timing and rhythmicity of movement needs to be given to children with ADHD [7].

The basic principle of rhythmic therapy is that by training the brain to follow the organized rhythm, improvement of the attention control system and executive function can be achieved following improvement in brain synchronization and networking [17]. Rhythmic therapy can be given with help of instrument, for example with Interactive Metronome®, or by rhythmic activities.

Interactive Metronome® is a computerized instrument used to train timing and rhythmicity of hand and foot movement by the help of auditory cues [18]. Interactive Metronome® instrument consists of a computer, Interactive Metronome® software, two set of headphones, and two triggers which can detect contact in the form of gloves and flat plastic board [19]. The

computer presents the participant of the training with reference sound through headphones with a certain rhythm that needs to be followed by the participant; the participant can either tap his/her hand or tap his/her foot to the flat plastic board as a response to follow the rhythm. Each response given by the participant is sent to the program, allowing the program to check the accuracy of the response and provide a score as feedback for the participant. In a research conducted to assess effectiveness of Interactive Metronome® for children with ADHD identified several pattern of inaccurate responses which they classify into five groups: dissociation (i.e. responses are random and not related to the rhythm of reference sounds), contra-phasic (i.e. responses are given between reference sounds), hyper-anticipatory (i.e. responses are given far before reference sounds), hypo-anticipatory (i.e. responses are given far after reference sounds), and auditory hypersensitivity (i.e. participant score better without guiding sound) [19].

Another alternative of rhythmic therapy is through rhythmic activities by using the metronome as reference sound. Several suggested rhythmic activities including clapping hands, jumping, and hitting drums. This form of therapy is supported by a research conducted by Brodsky and Sulkin [20] which conclude that children who routinely singing a rhythmic song by clapping hands are shown to possess better motor performance than those who don't.

Cognitive-functional intervention

Cognitive-Functional (Cog-Fun) intervention is a therapeutic method developed for children with ADHD which is based on cognitive rehabilitation models in occupational therapy and aimed to improve self-efficacy and executive strategies in occupational performances [10,21].

The intervention consists of one session per week that last for 1 hour where occupational therapist introduces executive strategies (e.g. stop, recruit effort/persist, check, plan) to the child to reach tailored occupational goals [21]. As emphasized by Hahn-Markowitz et al. the occupational context provided in the intervention in the form of fun activities is essential to promote internalization of executive strategies.

The randomized controlled trial study revealed significant improvement of executive function and participation of children with ADHD following a series of Cog-Fun intervention session [10].

DISCUSSION

Physical activity and exercise

In general, routine physical activities is related to improvement in brain function, including cognitive function, as an effect of increased brain vascularization, increased dopamine concentration, blood vessel growth, an increased neural connection. Improvement in neural connection along with catecholaminergic pathways has the potential to decrease symptoms of ADHD [22]. Previous researches have shown evidence of symptoms improvement following physical activity and exercise [23,24]. The physical activity has a similar effect with methylphenidate for attention performance in children with ADHD. Parents of children with ADHD also reported improvement of symptoms after their children underwent physical activity program [25]. Additional benefits of exercise are a reduction of depression and anxiety, improvement of self-confidence, increased motor coordination skills, and increased excretion of metabolic waste and toxic [26].

Executive function disturbance as the core symptoms of ADHD can be improved through exercise. Piepmeyer et al. [27] found that acute exercise can improve various components of executive function, including working memory, inhibition response, attention, and planning. This finding is supported by evidence of increased brain activity recorded by electroencephalography (EEG) following exercise as a sign of working memory process [28]. The mechanism behind the improvement of executive function is thought to be the effect of nerve stimulation, increased growth factor, and increased neurogenesis following intense exercise [22].

Physical activity can be in form exercise, sport, or games. Various types of physical activity and exercise that have shown benefits for ADHD include circuit training, games focusing on motor skills, cycling, and treadmill exercise. In choosing the type of physical activity for a child with ADHD, it is important to consider the child's sensory profile, coordination skill, social skill, and degree of physical fitness. Children with ADHD also tend to easily get bored, therefore variation needs to be made to exercise routine. Minimal recommended physical activity duration is 30 minutes, but further researches are needed to determine optimal exercise intensity and duration that can be prescribed to improve symptoms of ADHD.

Occupational group therapy

In general, the purpose of occupational group therapy is to help its participant to improve social participation through training of communication skills and daily activities [23]. Symptoms of ADHD often cause children unable to obtain optimal social skills and participate in social activities. Social participation, including formal and informal activities, is very important for children because it helps the children to develop various social skills, such as sharing things with others, cooperation, helping others, and conflict resolution [29].

Implementation of occupational group therapy can incorporate various occupational therapy methods in different sessions, for example, Cog-Fun group therapy, physical activities group therapy, and rhythmic group therapy.

CONCLUSION

A variety of occupational therapy methods are proposed for children with ADHD, it is important for a psychiatrist to have the knowledge of these occupational therapy methods to be able to integrate them with standard therapy and form comprehensive management for ADHD. This review suggests that, despite existing supporting evidence, further researches are required to establish the efficacy of occupational therapy methods. Therefore, care needs to be taken when incorporating these methods with standard therapy. Parents also need to be informed of the current evidence that supports each therapeutic method and has to receive education to monitor progress during therapy. This review is limited by studies selection methods and requires improvement in a future study.

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