APPLICATION OF YOGA THERAPY AND ACUPUNCTURE IN MANAGEMENT OF AUTISM SPECTRUM DISORDER (ASD) – A NARRATIVE REVIEW

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ABSTRACT

OBJECTIVES: Autism is a neuro-developmental disability, associated with considerable behavioral, social, and communicational challenges. As there is no treatment to completely cure autism and associated symptoms, many alternate methods of therapies such as yoga, acupuncture, reiki, animal therapy etc. are considered to minimize the symptoms. In this literature review, we have examined beneficial effects of yoga therapy and acupuncture in patients with autism spectrum disorder.

METHODS: We have searched the following databases: MEDLINE, Embase, Scopus and PubMed. The search strategy was limited to articles in English. We have kept the study design broad and have included both randomized and open label trials and meta-analysis papers to get information on effectiveness of ancient therapies on ASD.

RESULTS: Yogic meditation sessions were effective in improving the brain activity by reducing anxiety and stress. Yogic postures improved musculoskeletal functions. Acupuncture methods improved communication, physical ability, self-care abilities and behavior in children with ASD.

CONCLUSION: Yogic interventions were found to trigger parasympathetic dominance which is essential to attain physiological and psychological balance. Though considerable limitations are associated with these approaches, these therapies can still be considered as effective tools in improving autism related symptoms.

KEYWORDS: Autism Spectrum Disorder, Yoga, Acupuncture, Therapeutic effects

INTRODUCTION

Autism is a multifactorial, neuro-developmental disability that can cause substantial behavioral, social, and communicational challenges. Avoidance of eye contact, lack of emotional understanding and control, restricted range of activities and interests are some of the social behaviors in these patients [1]. According to WHO, it affects around one in 100 children and males are affected more than females [2]. Etiology of autism spectrum disorder (ASD) is still debatable; however, it is hypothesized that a combination of genetic and environmental stimuli is the root cause [3]. Although no cure exists for ASD, many approaches are available to help these patients to minimize the symptoms and maximize their abilities. Pharmacological therapy with drugs can help to reduce the associated disorders like irritability, hyperactivity and aggressive behavior [4]. Though, short term treatment with drugs is safe, long-term administration may lead to adverse effects such as tremor, dyskinesia, rigidity, akathisia, drowsiness and difficulty in swallowing, as seen in case of risperidone treatment [5]. Moreover, these drugs are not found to be effective in reducing the social and language barriers for most patients with ASD. Other treatment modalities include Applied Behavioral Analysis (ABA) [6], nutritional therapy [7], speech and language therapy [8], and occupational therapy [9]. But these treatments often fail to address the psychosocial challenges of patients with ASD.

Since there is no cure for ASD, there has been growing interest in alternative forms of therapy; opted by many parents. Art therapy, one among the alternative therapies, includes creative medium such as painting, music, poetry, drama and writing [10] to

increase self-awareness, mental health and overall wellbeing of patients. Yoga, acupuncture, reiki, animal therapy is some of the other forms of alternate therapies. In this literature review we have examined the effect of ancient methods of therapy such as yoga and acupuncture in patients with ASD and how these approaches influence the patients to improve their social, behavioral and communication skills. Though more research is needed, there is encouraging evidence in the literature survey to show that these therapies can effectively improve ASD related symptoms and help patients to inculcate positive behaviors.

METHODOLOGY

We have searched the following databases: MEDLINE, Embase, Scopus and PubMed. The search strategy was limited to articles in English. We have kept the study design broad and have included both randomized and open label trials and meta-analysis papers to get information on effectiveness of ancient therapies on ASD. Case studies and case series were excluded from the study. After retrieving all papers, relevant information to support the effectiveness of ancient therapeutic measures in treating ASD were selected. All the papers were reviewed independently by all the authors and papers were selected by mutual consent.

RESULTS AND DISCUSSION

YOGA THERAPY

The word ‘Yoga’ is derived from the Sanskrit root where, ‘Yuj’, meaning ‘to join’. Yoga practices bring about a perfect harmony between the mind and the body [11]. In

yoga therapy, yogic principles are applied to a particular person to improve his health and wellbeing. Yogic sessions may include meditation, breathing techniques, various postures, and relaxation techniques. It has been hypothesized that relaxation and breathing techniques improve concentration, reduce anxiety, and help to calm the person. Sequences and transitions between poses of various asanas benefit individuals by increasing muscle tone, balance and stability, development of motor skills and overall body consciousness [12]. Thus, regular yoga practices may promote a sense of calmness, greater self-control and largely increase the quality of life [13]. Meditation, irrespective of being traditional (Buddhist and Hindu traditions) or modern, is a method to train the mind to attain a higher state of consciousness. It is believed that higher states of consciousness eliminate duality and conflicting thought processes of the mind, and aid in achieving calmness, a sense of connectedness and self-control.

Benson et al [14] first attempted to describe the beneficial role of meditation. They reported that, diseased state is due to the activation of sympathetic nervous system. Inner calmness or the relaxation achieved from meditation is in general thought to decrease sympathetic activity and enhance the parasympathetic activity. Though some authors describe the effect of different meditation practices [15], majority of the researchers follow individual technique to show the effect of meditation. The practice of meditation showed a positive impact in enhancing the social interaction and communication skills in children with ASD by reducing anxiety and improving mental health [16]. Practice of transcendental meditation by six autism patients twice daily for

15–20 min (minimum requirement was at least 10 times per week) for 3 months, showed improved sleep and social interaction as well as reduced levels of stress and anxiety [17]. A meta-analysis of 10 neuroimaging studies comprising a total of 91 subjects, provided a better understanding of the brain areas likely to be active during meditation. Based on activation likelihood estimation (ALE), the authors showed the activation of three brain areas: the basal ganglia (caudate), the entorhinal cortex (limbic system), and the medial prefrontal cortex (MPFC) during meditation. These areas are responsible for various cognitive processes such as emotional regulation, learning and memory, imagination, response inhibition, behavioral control, self-referential thinking and spontaneous thought generation and monitoring. The authors proposed that during the meditative state, caudate nucleus inhibits irrelevant stimuli, entorhinal cortex controls the mental stream of thoughts and MPFC enhances self-awareness by supporting the inner engagement of attention18. Pointing at the substantial deactivation of precuneus, insula, parietal, temporal and different prefrontal regions of brain area during meditation, the authors also hypothesized that the deactivation of these brain regions together with the activated regions plays a major role in the optimum balance of brain activity during the meditative state [18].

On reviewing 11 studies probing the effects of yoga practice on the brain health, Gothe, Neha P. et al. demonstrated the positive effect of yoga on the brain structure and function, hippocampus, amygdala, prefrontal cortex, cingulate cortex and brain network structures [19]. Thus, long term yoga practices may impact directly on the wellbeing of children with autism. Radhakrishna S, in an uncontrolled open trial,

studied the impact of integrated approach of yoga therapy (IAYT) in six ASD children with age group of 8-14 years. The yoga interventions included warm-up asanas, strengthening asanas (trikonasana veerabhadrasana and parshavakonasana), calming asanas (sukhasana and shavasana), breathing and release of tension asanas. After IAYT application of 5 sessions per week for 10 months and regular practice thereafter at home, significant improvement in imitation skills, communication, language, eye contact, and motor control were observed [20]. Applied Behavior Analysis-based (ABA) training combined with IAYT was carried out by Radhakrishna S as an extension of the same study. A 15-hour ABA-based training and 5-hour IAYT was practiced weekly for two 10-month academic years with a gap of 2 months for summer holidays. The yoga interventions included warm-up and loosening practice sessions, practicing strengthening asanas (trikonasana veerabhadrasana, parvathasana, sasankasana), calming asanas (sukhasana, shavasana and makarasana), yogic breathing practices, and chanting. The authors observed significant improvement in eye contact, imitation skills, communication, and motor control in these children [21]. Effect of yoga intervention on short-term heart rate variability in children (intervention group n=25 and control n=25) of age group 8–14 years with autism spectrum disorder was carried out by Vidyashree HM et al. Yoga intervention was given for 3 months with 30 minutes of daily practicing asanas (strengthening asanas, calming asanas and chanting of OM). The activity of the cardiac autonomic modulation was recorded by short-term HRV before and after yoga therapy. The research group concluded that yoga interventions were beneficial in bringing parasympathetic dominance which is essential

to attain physiological and psychological balance [22]. In another study, yoga interventions done on 24 children with autism for 16 weeks, showed significant improvement in their classroom behavior as assessed by their teachers [23]. Yoga practices including various asanas and the chanting of AUM for the total duration of one hour before lunch showed enhanced musculoskeletal function with enhanced neurological response [24]. In a large group study (n=32), after 90 days of yoga intervention, children with autism showed reduction in self-injurious behaviors and improvement in eye-to-eye contact, sleep patterns as well as their digestive problems [25]. A pilot study with application of yoga therapy along with music and dance also showed improvement in behavioral and cognitive symptoms with children with ASD [26]. After extensive review on the beneficial effects of yoga poses on psychological conditions and many other clinical conditions, Field T [27] opined that, positive effects of yoga interventions on mind and body could be due to the stimulation of dermal and/or subdermal pressure receptors. Such stimulation causes higher vagal activity and reduced cortisol level. Higher vagal activity may contribute to better brain function and reduction in cortisol may lead to enhanced immune function.

LIMITATIONS/DISADVANTAGES OF YOGA THERAPY

Though there are promising outcomes on the beneficial role of yoga in improving the physiological and psychological balance, self-confidence, learning abilities and communication skills in children with ASD, limited research works are available to get a clear conclusion on the effectiveness of yoga interventions in children and adolescents with ASD. Some of the limitation of yoga intervention are the small sample

sizes, uncontrolled open trails with lack of randomization and limited details regarding the intervention etc. The majority of the works showed the results of yoga intervention for a shorter duration of time. Since different yoga postures and sequences were adopted by different groups of researchers, a more rigorous and well-designed research protocol is required to evaluate the effectiveness of this alternate therapy in ASD subjects.

ACUPUNCTURE TREATMENT

Acupuncture is a traditional Chinese medicine, used in the treatment and prevention of many diseases for over two thousand years. According to this medicine, abnormal flow of "*qi*" (life energy) and "*xue"* (blood) determines the pathophysiological concept of disease and acupuncture deals with removing obstructions of *qi* and/or *xue* [28]. Acupuncture meridians are the channels through which meridian *qi* flows. The meridians are composed of *Yin* and *Yang* meridians which cover all parts of the body and are distributed on the body surface. Meridians connect vital organs; also called Zang-Fu such as the heart, the liver, spleen, lungs etc. to each other and to the surface of the body. All the Zang-Fu organs relate to the central nervous system. Good health requires the balance of *Yin* and *Yang* with one another in Zang-Fu organs and the smooth flow of *qi* throughout the body harmoniously. In the technique of acupuncture, needles are placed along the specified acupuncture points or 'acupoints' which facilitate the regulation of the functions of the Zang-Fu organs through undisturbed flow of *qi* through the meridians [28, 29]. Structurally, acupoint sites contain abundant

nerves, muscles, vessels, and tendon. During acupuncture, a signal gets transmitted to the CNS through the peripheral afferent pathway and the brain sends the therapeutic signals required for healing through the efferent pathway [30]. As there are 400 acupoints, the exact scientific basis of how acupuncture improves the various cognitive and behavioral functions in patients with ASD is still debatable. Investigators propose that neuroanatomical and neurochemical events occurring early during the development of the central nervous system is responsible for the pathophysiology of autism. Many researchers showed that neurotransmitters that regulate various cognitive and behavioral functions of the brain such as Gamma aminobutyric acid (GABA), glutamate, serotonin, dopamine, melatonin, acetylcholine and many others are altered in individuals with ASD [31]. The signal transmitted during acupuncture influences the synthesis, release and reuptake of these neurotransmitters [32] and consequently becomes effective in improving the behavior and/or development in children with autism.

Various forms of acupuncture interventions such as scalp acupuncture, laser acupuncture, electro-acupuncture, etc are used in healing human ailments. In a pilot observation study, after 16 biweekly treatment sessions of acupressure/acupuncture to 10 children of ages 3-10 years with ASD, significant improvement in restlessness, distraction, sleep delay, hyperactivity and impulsiveness, children's expressive and receptive social communication was observed from pre- to post-treatment [33]. Many investigators studied the effectiveness of Scalp Acupuncture Treatment (SAT), in patients with ASD. In scalp acupuncture, the needles are inserted subcutaneously into

specific points (acupoints) on the entire sections of various zones. According to western perspective, these zones are related to the cortical areas of the cerebrum and cerebellum, mediating various functions of the central nervous system such as motor, balance, sensory, hearing, speech, vision, etc. By stimulating these areas, functional activities of the brain can be well regulated, which in general helps to restore and strengthen the functions of the various organs and tissues throughout the body [34]. The therapeutic effect of scalp acupuncture on natal autism and regressive autism with 68 autistic children showed that scalp acupuncture improved verbal communication problems. The therapy was found to be more effective in patients with natal autism than those with regressive autism, indicating that therapeutic effectiveness decreases with increasing age [35]. In a meta-analysis, considering 11 articles, authors showed that SAT improved communication, physical ability, and behavior in children with ASD [36]. Laser acupuncture or laser puncture used in modern medicine employs low-intensity, non-thermal laser irradiation to stimulate the acupoints [37]. Owing to various advantages of this method such as ease of application, delivery of accurate doses, non-invasiveness and painlessness, laser puncture has been found to be effective in relieving symptoms of ASD. In a randomized, double-blinded clinical trial with control and treatment group consisting of 23 children with ASD of the age group of 2-6 years, verum laser puncture therapy for 18 sessions (3 times per week for the duration of 6 weeks) showed improvements in speech ability, eye contact, facial expression and social interaction in these children [38]. To study the effects of short-term electro-acupuncture for children with ASD, Wong VC et al conducted a randomized, double-

blinded, sham-controlled, clinical trial (n=30). After, four-week (12 sessions) course of electro-acupuncture, they concluded that language command and self-care abilities were enhanced in these children [39].

LIMITATIONS/DISADVANTAGES OF ACUPUNCTURE TREATMENT

Regardless of the various acupuncture treatment methods used, in another meta-analysis considering twenty-three randomized controlled trials (RCTs), authors evaluated the effectiveness of acupuncture in children with ASD. It has been concluded that acupuncture may be safe and effective in pediatric ASD though the method is associated with mild adverse events such as bleeding, pain and irritability [40]. Some of the limitations of acupuncture are small sample size, heterogeneity of the acupuncture treatment methods used and low methodological quality of these studies. Since substantial number of research works have been conducted and written in Chinese, we have failed to obtain detailed explanation of study design and information. From the various papers reviewed we may conclude that a well-designed RCTs with larger sample size may be needed to get clear idea on the effectiveness of acupuncture on ASD.

CONCLUSION

Yogic interventions were found to trigger parasympathetic dominance which is essential to attain physiological and psychological balance. Yogic meditation sessions were effective in improving the brain activity by reducing anxiety and stress. Meditation was also found to improve the social interactions and communication skills in children with ASD. Yogic postures improved musculoskeletal function. Irrespective

of the various acupuncture methods used, these methods improved communication, physical ability, self-care abilities and behavior in children with ASD. Since these therapeutic methods were associated with limited risks, they can be used as an alternate method to improve various autism related symptoms. But well-designed studies with a large sample size, including a single type of intervention may be required to get more idea on the therapeutic use of these methods in autism.

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