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The Aquatic WATSU® Therapy Program Improves the Quality of Life of an Adult Male with Autism Spectrum Disorder. A Case Report

Authors' contribution:
A) conception and design of the study
B) acquisition of data
C) analysis and interpretation of data
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E) obtaining funding

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Abstract

The purpose of this single case study was to investigate the effects of the WATSU training program (WTP) on 21 years old male with an Autism Spectrum Disorder (ASD). This study used a high level of individual and structured interventions to improve the underperforming adaptive functioning areas like social and academic skills in ASD. The individualized intervention of WTP was completed in five days using critical verbal and bodily language, technical demonstration, taking turns, basic skills, and timely feedback in a social and sensory-isolated environment. The results were collected via in-training observation, semi-structured family and athletic trainer interviews to evaluate the participant's condition before and after the WTP. The structured communication opportunities improved the sense of trust and played a prominent role in the development of the quality of life. The results indicated that WTP reduced repetitive movements, stress reactions, challenging behaviors, and improved communication skills. In addition, changing roles, positions, and transitions in WATSU training increased the participant's resiliency in his life with more comfort. Finally, tactile-emotional quality afferents, warmth, and buoyancy of the water, altered and enriched proprioceptive and vestibular input, being safely cradled in the arms instructor were likely to be the other factors improving the underperforming areas including communication, repetitive movements, stress reactions and challenging behaviors.

Keywords: Autism spectrum disorder, WATSU aquatic therapy, sensory integration, social skills, mindfulness

Introduction

An Autism Spectrum Disorder (ASD) is defined as a combination of impairments in reciprocal social interaction, verbal and non-verbal communication, behavior patterns, interests, activities, and sensory regulation (Geslak et al., 2021; Grandin, 2019; Pratt et al., 2017). The USA prevalence of ASD is approximately one in 54 children (Aylward et al., 2021). Reasons for the rise of ASD prevalence are still widely debated but not the lower life expectancy than the general population (Martin & Dillenburger, 2019). ASD shows deficiencies significantly in communication, social, cognitive, sensory, and behavioral challenges (Geslak et al., 2021). The lack of social communication, understanding, and engagement in age-appropriate social behaviors with the presence of restricted and repetitive behaviors is apparent. The deficits are attributed to the lack of flexible thinking across contexts, taking other people's perspectives, eye contact, reading social cues, and understanding non-verbal communication (Pratt et al., 2017), attention deficit hyperactivity disorder, obsessive-compulsive disorder, and mood disorders or other disruptive behavior, psychiatric problems and poor sleep (Hodges et al., 2020; Lawson & Little, 2017). Also, sensory processing constitute an essential part of the common symptoms making new situations and changes challenging (Robertson et al., 2017).

In ASD, a dyadic nature or interactions with the peers, therapists or parents are the main requirement in many intervention studies such as peer-mediated and psycho-social interventions and therapies (Bishop-Fitzpatrick et al., 2014; Cambric & Agazzi, 2019; Chang & Locke, 2016). In addition to fact, that interventional studies improve cognitive, social, and motor functioning (Hodges et al., 2020) physical activity (PA) interventions improve body image, self-esteem, mood, communication and sensory regulation, while decreasing anxiety and problem behavior (Konukman et al., 2017; Yılmaz et al., 2020).

Exploring New Interventions for Adults with ASD

The need for decreasing problematic behaviors and developing social skills in ASD is the main driver in the search for effective interventions (Cambric & Agazzi, 2019). The correlation between the motor and social impairments in ASD (Craig et al., 2021) necessitates a high perception of safety and makes sensory rich interventions more preferable. Also, keeping the therapies as the primary means of intervention (Reinders et al., 2019) in mind, Aquatic interventions (AI) as exercise or non-exercise aquatic bodywork i.e. aquatic therapy forms might have a great potential to reduce activity limitations and participation restrictions. Therefore, aquatic therapy forms should be comprehensively investigated due to the obvious need for innovative interventions in ASD (Busti Ceccarelli et al., 2020; Scharoun et al., 2017).

Besides motor and physical fitness benefits, aquatic exercises improve relaxation, autonomy and negative behaviors (Kanupka et al., 2016; Marzouki et al., 2022; Zanobini & Solari, 2019). Water-based interventions are likely to enrich the afferent sensory input due to floatation, hydrostatic pressure, density, viscosity, resistance, and flow properties that reduce stress and improve neuro-motor and musculoskeletal conditions (Dubois, 2011; Tufekcioglu, 2020; Tufekcioglu et al., 2021a). These beneficial water properties contributes to the increased use of aquatic interventions (AI) in ASD as an interdisciplinary treatment component for self-confidence, self-esteem, language skills, motor learning, social skills, cardiorespiratory endurance, muscular functioning, (Battaglia et al., 2019; Marzouki et al., 2022 Pan, 2011; Yilmaz et al., 2004).

It is also worth mentioning that the number of adults with ASD will be increasing dramatically in the coming years (Bishop-Fitzpatrick et al., 2014). This is particularly concerning given that the lifetime per capita societal cost of autism is $3.2 million. More importantly, the areas of lifelong condition management that contribute most to the per capita cost of ASD are adult care and lost productivity and relatively little work has investigated the most effective ways to treat adults with ASD (Bishop-Fitzpatrick et al., 2014).

WATSU: A Close Contact Aquatic Therapy

WATSU therapy is defined as a gentle one-on-one bodywork applied in warm water (34-35°C) during which the therapist's close contact is needed to support client's head and body in a gentle way throughout the session (Dull et al., 2023). Thus, manipulating, rocking, stretching and massage forms are applied to the clients in a rhythmic way. WATSU therapy is recommended for various impairments such as orthopedic, neurological and rheumatoid problems. Besides, improving autonomic and emotional balance and gross motor functioning is also targeted (Schitter et al., 2020; Tufekcioglu et al., 2021b). In WATSU, the focus is on holistic listening, individualized and immediate adaptations, continuous support, and the quality of "presence" (Dull et al., 2023). These critical elements of WATSU therapy might help form individualized care to support competencies in ASD.

WATSU Therapy Training Program

Visual, verbal, gestural, partial and complete physical prompts are used to support motor learning skills in WTP. In general, a structured learning environment is necessary for WTP to maximize the altered sensory effects on learning similar to adapted physical activity and teaching sports in ASD. Structuring includes determining boundaries for practice by visualizing the boundaries, practicing the techniques in a specific order,

breaking them into small parts, and building on them. Other WTP structuring elements such as predetermined time, organized space, teaching materials, and one-on-one practices help increase individualization, engagement, and independence. Thus, individualized social interaction in WTP's therapeutic environment may provide multiple sensory stimuli to improve social interaction considering the evidence that especially proprioceptive sensation plays a critical role in improving the underdeveloped areas in ASD (Dubois, 2011).

Moreover, WTP offers predictable routines, visual and structural supports, technical demonstration, bodily and verbal language, taking turns, and getting feedback in a social setting and isolated environment to tackle the core social communication, behavioral deficits and motor impairments in ASD. Given the potential benefits, this case study reports and discusses the changes observed in a male individual with mild ASD during and after WTP. The effectiveness, feasibility and acceptability of WTP for improving social interaction, adaptive behaviors, and tolerance of touch are discussed. Attention span, listening skills, balance, initiation and maintenance of eye contact, language development and sleep pattern as secondary outcomes were also discussed. Finally, this first study on WTP in ASD is likely to be supportive of families and health professionals by providing insights on a new educational aquatic intervention.

Method

We used qualitative research methods in the study. According to Yin (2009), a case study is an observation-based research that examines a current phenomenon in a real-life context. A *case study* is a qualitative approach that aims to analyze a particular subject or situation in depth by collecting data from many sources and describing a situation or its themes (Creswell, 2017). This study used a single case design to evaluate the condition of an ASD patient before and after the WTP. Therefore, there is only one analysis unit in single-case designs, such as an individual, an institution, a program, or a school (Yıldırım & Şimşek, 2008). Yin (2009) stated that collecting data from different sources in a case study is essential to ensure the construct validity of the study. For this reason, researchers kept the notes of in-training observations and made individual interviews with family and athletic trainer to evaluate the participant's condition before and after the WTP. IRB permission (#2018-11-04) obtained from the board of the rehabilitation center prior to the study.

Subject

The participant was selected according to the criterion sampling method with a purposeful sampling strategy for the study. The purposeful sampling method is the selection of information-rich situations in the context to conduct in-depth research (Büyüköztürk, 2019). The criterion sampling method, on the other hand, is the creation of the sample from people, events, objects or situations with the qualifications determined for the problem (Büyüköztürk, 2019). The inclusion criteria for the study were defined as having a mild ASD with low attention levels to social cues and engagement with social interactions in daily life. It was decided to involve MDC in the WTP as the main participant who met these criteria.

MDC was born in 1997; he could not speak or walk until 2.5 years old. He seemed to be an introverted child who did not communicate and make eye contact but constantly looked at the same point for a long time. After analyzes of MDC's developmental and behavioral tests scores, his physician diagnosed him with ASD which is still within the definition of mild ASD in the new DSM V classification.

MDC's Rehabilitation & Therapy & Education History

After diagnosis, his family continued his rehabilitation at home until he was five years old. The rehabilitation at home was not sufficient. He participated in special education and rehabilitation work for two years at a Medical school. MD, who has mild verbal ASD with close to average IQ level, started regular school at 9 years old. He completed primary education by staying at school for up to 2 hours/day. He had shown a character of hyperactivity and low concentration. He used to choose solitude activities and be irresponsive when called several times. He showed no interest in the games played by his peers, which might have aggravated his communication skills. Repeating the words was his response to vocal stimulations, and staring at one point was too often in that years. After a severe seizure attack at the age of 14, he was hospitalized for a short time, after which he used Risperdal regularly for two years. His mother stated that „*he was hyperactive before the seizure attack and the drugs he used afterwards. After the treatment, he became more introverted, not moving unless he had to, and constantly wanting to eat*". During these years, he did not attend school due to his perceived behaviors not conforming to the unwritten standards. He could not be given special education, which limited outdoor activities.

MDC's Athletic Development

At the age of 18, he was 152 kg. Due to behavioral, sleep, anger control problems, and deterioration in his physical and psychological condition, his father decided to register him in sport activities such as track and field, swimming and cycling via hired professional sports trainers. As a result, these supervised physical activities

provided significant benefits to MDC. He lost 60 kg in one year, resulting in improved body composition, motor skills, and decreased aggressive behavior. Then, he won many medals from national and international competitions in swimming, ironman, marathon, and cycling. He earned the ironman statute in international competitions. He improved his social life, communication skills and behaviors such as making simple physical contact and handshakes but avoiding hugs. However, his family also observed that MDC showed some negative behaviors such as self-talk, increased anxiety, sleep deprivation, and imitation of the trainer due to heavy training, repetitions, and continuous verbal encouragement during the intense period of his athletic training.

Consequences of the First WATSU Bodywork Therapy

In these times of high stress and demand, he received a WATSU therapy session for the first time, after which his family and his athletic trainer decided to relax him using WATSU therapy. Considering his resistance to hugs, avoiding physical contact and increasing stress responses during in-season, his athletic trainer and his family wanted to obtain more benefits using WATSU therapy via the WTP, where he can be held for long hours and hold others. Therefore, MDC's athletic trainer asked a professional WATSU instructor about MDC's possible participation. They both made an initial observation to analyze potential benefits and risks for his continuity in the WTP, resulting in his acceptance in the first-level WTP.

WTP Procedure

Each individual with ASD requires an individualized course of intervention. MDC was one of 8 participants in an individualized and structured 5-day intensive WTP in a private rehabilitation center with a warm water pool in an adequate level of sensory isolation. Before technical training, WTP began with demonstrating and hands-on experience of water properties such as buoyancy, water resistance, and viscosity. Each day new WATSU techniques were taught with verbal, physical, and visual (demonstration, gesture) prompts for independent performance. Each day of WTP included water work (6 hours/day) and land work (4 hours/day). During WTP, all participants frequently changed their roles from applying to receiving the techniques and vice versa and change with each other to enrich gross and fine motor skill integration by increasing the sensory experiences.

Data Collection Instruments

In-training observation forms and notes using data diversity to ensure internal validity, semi-structured individual interviews with family and the athletic trainer were used to evaluate the before and after the WTP as data collection tools. The data were discussed and interpreted with the field experts. Inter-coder reliability, the consensus among coders, is an essential method in ensuring the reliability of data analysis results (Miles & Huberman, 1994).

Semi-Structured Individual Interview

This interview technique is one of the critical data collection tools to provide in-depth information in qualitative research (Hancock & Algozzine, 2006). The participant was informed about the subject and content of the study. A voluntary participation form was signed by the participant, and a voice recording was taken with the permission of the participant's father. Three interview questions were prepared under expert supervision according to the objectives. The researcher conducted an in-depth conversation during the interview with the questions asked: 1. What are the main socio-emotional behavior changes that MDC has shown after WTP? 2. What improvements have you seen in MDC's reactions to close contact? 3. What are other improvements in his challenging behaviors? While preparing the interview forms, two expert opinions were consulted to ensure content validity. The interviews lasted between 10 and 30 minutes.

Observation Form

Observation for an in-depth description of behavior happening in an environment requires method if the researcher wants to obtain a detailed and time-consuming image of conduct (Yıldırım & Şimşek, 2018). The researcher wrote short notes by observing throughout the process to get to know the participant better and better express the actions taken during the research. These notes helped the researcher fill out the observation form more objectively. The collected data were analyzed using the content analysis technique. According to Yıldırım and Şimşek (2018), in content analysis, similar data are combined within the framework of specific concepts and themes and interpreted understandably in content analysis.

The data obtained from the semi-structured interviews and observation forms were coded independently by two different experts, and the results were compared with each other. For the reliability of the qualitative data of the study, the formula "Reliability coefficient = Consensus / (Agreement + Disagreement) / 100" was used (Miles & Huberman, 1994) and the coder reliability was calculated as .84. The researcher filled the observation forms throughout the activities to better express performance and defined the participant better in terms of validity and reliability in this study. Additionally, the validity and reliability were determined by comparing the researcher's observations with the observations of the field expert.

Table 1. MDC's observed outcomes that showed improvement

Motor	Social	Emotional	Self-Regulation	Communication
Movement Control	Agression / Stress Reaction	Being Valued / Understood	Repetitive Movements	Reciprocal Language
Body awareness	Following Rules, Turn-Taking	Sense of Connection / Acceptance	Resilience / Mood	Eye Contact
Balance	Prompt Response	Self-Confidence	Self-Agression	Vocalizing needs
Coordination	Empathy / Sharing	Trust	Touch Tolerance	Listening
Skill Acquisition	Attentiveness	Engagement	Calmness	Using names
Problem Solving	Posing Questions	Estrangement	Sleep	

Results

Motor Skill Acquisition

The outcomes of the study were observed based on initial assessments completed by MDC's athletic trainer, the WATSU instructor and family members. The first explicit outcome was about technical mastery throughout WTP. MDC applied the movements, gradually increasing proficiency without getting tension. MDC indicated more tendency to touch and hug with his increasing adaptation especially starting from the second day of the WTP. Acquisition of WTP techniques requires the toleration of touch, improved balance in water and body awareness. Therefore, the increased movement control and better imitation of the other participants were significant on the fourth and fifth days of WTP. However, the transitions of movements on time and seamlessly and a few hand placements were late-developing areas.

The WATSU instructor's feedback based on watching and receiving was critical information about MDC's learning and overall performance during WTP. The WATSU instructor confirmed that "*MDC performed techniques well, except for a few small mistakes in hand placement. MDC stayed with the order of the techniques when he performed independently. When verbally guided, MDC tended to make more mistakes."* MDC's athletic trainer stated that "*his toleration of touch, anxiety, initiation and maintaining eye contact, use of language, mood, and sustained attention were way better in WTP than usual*". MDC's athletic trainer added that *"MDC used to stay away from his friends before WTP, but he was more communicative with his friends after WTP.* Moreover, MDC's trainer confirmed that "*He responded more positively to people touching and hugging him."*

Social Skill Improvement

The researcher observed reduced aggressive behaviors, enhanced responses to prompts, fewer prompt requirements, being on task more often, increased reciprocal and expressive language skills, prolonged and frequent eye contact, sharing food with others, and responding promptly. According to his athletic trainer and family evaluation, MDC's simple need expressions and appropriate answering yes/no questions improved significantly after WTP. In MDC's WATSU technique performance evaluation as a follow-up one month after WTP, MDC's athletic trainer reported that "*MDC improved his listening skills, turn-taking, joint attention, resilience, patience, and problem-solving ability*". The athletic trainer stated that "*MDC showed great interest, calmer state and higher communication skills".* The athletic trainer added that "*MDC maintained prolonged eye contact and increased adaptation capacity to the environment in his daily life".* MDC's statement that *"I slept better and longer. My focus is better during WTP than usual"* showed consistency with these observation results.

Self-Regulation Improvement

MDC's mother confirmed his overall well-being and stated that "*self-confidence, state of calmness, and sleep pattern were way better compared to his condition before WTP*". MDC's mother confirmed the absence of overreaction when touched, hugged and kissed. Further, she added that "*MDC started kissing the family members sometimes*". MDC's parents expressed that "*he has not done such positive social activities in the past 20 years*". More specifically, the parents reported improvements in "*self-aggression, self-injurious behaviors, screaming, and the vocalizing needs starting from the third day of WTP."* Many prompted behaviors were transformed into independent types such as showering, preparation for entering the pool and exiting the pool, leaving the facility on time, and having little snacks during the breaks.

Discussion

In this first case report of its kind, the WTP induced changes in the technical acquisition, stereotypical symptoms and socio-emotional skill gains of a 21-year-old adult male with mild ASD were discussed.

MDC's technique acquisition endorsed by researcher, athletic trainer and the WATSU instructor is promising. We can deduce that the complex motor movement sequence gain of an adult individual with mild ASD in a social and relaxing warm pool environment is not less than the average of the general population.

Motor Learning

The observed calmness and relaxed state of MDC during WTP might have underpinned the gradual motor learning, including the proper muscles' contraction and matching the rhythm of movements. Timely supportive prompts in WTP increased predictability in performing the technical sequence and reduced MDC's unpredictability-related anxiety. The absence of MDC's stress reactions due to WTP's consistent and predictable structure and individualization might have contributed to his observational learning and technique acquisition. The visual support with the continuous technical demonstration could have assisted him in maintaining the correct technical sequence with a good transition between the movements.

It is likely that the one-on-one practices in the WTP might have improved individualization and independence in free practice times. Considering the study by Sefen et al. (2020), the implication that individualization with family members taking role in WTP may have additional emotional benefits. The extra self-practice time might have reduced dependency on verbal prompts, demonstration, and other visual cues. For high-level motivation and independent performance, his technical progress was supported by using rewards and effort appreciation. Effort appreciation is known to improve performance due to the activation and increased task-modulated connectivity in the occipital cortex (Olivo et al., 2021).

We believe that MDC's higher touch acceptance partially reflects the correlation between the social and motor skill that has already been reported (Craig et al., 2021). MDC could have improved his tolerance to touch via the continuous technical demonstrations in the form of close contact.

Participating in aquatic activities exposes the individual with ASD to various exercises that increase body composition, balance, flexibility, strength, endurance, and gross motor skills (Battaglia et al., 2019; Pan, 2011). Although the manipulative WTP techniques provide a non-exercise form of bodywork, the need for physical activity could have been partially met in a dynamic and meaningful environment. Moreover, soothing ai-chi like movements in the relaxing pool environment, massage effect and density of water could have provided a kind of recovery movement intervention from MDC's intense athletic trainings. MDC's mother reported reduced stress symptoms related to his heavy training after WTP. This reduced stress symptoms suggests WTP as an active recovery intervention for athletes with mild ASD.

Social Skills & Self-Regulation

MDC's parents remark that "*time spent in water during WTP helped him cope with everyday stresses better*" is in line with previous AI studies (Caputo et al., 2018; Zanobini & Solari, 2019). The family and the athletic trainer observed that MDC showed social and self-regulation improvements including language, toleration of touch, duration of eye contact, communication, listening skills, sleep, challenging behaviors and echolalia after WTP. These improvements further validate the continuous and optimal prompting in WTP to enhance the sense of achievement, engagement, self-confidence and learning. The WTP's sustained low-stress and high-predictability environment appears to support social adaptations.

Reduced stress factors in the WTP environment with predictability and an individualized approach might have strengthened MDC's sensory processing. WTP with modified auditory, visual and olfactory inputs with altered vestibular, proprioceptive and tactile inputs might have formed a sensory diet for MDC. Keeping the improved social and physical competence in mind (Güeita-Rodríguez et al., 2021), the WTP-specific sensory diet might have contributed to MDC's improved touch toleration, eye contact, and participation.

Considering the study by Phytanza & Burhaein (2019), being exposed to the fluid dynamics are likely to have biological impact on some of MDC's improved results. In previous studies, being assisted by trained peers in aquatics and land-based interventions in ASD was recommended (Bass & Mulick, 2007; Chu & Pan, 2012). Therefore, positive reinforcements, non-competitive social interactions and the eliminated oppositional behaviors in the WTP could have been other strong contributors on the improvement.

Emotional Processing Factors & Coupling

The coupling of biological rhythmic oscillations and visual and auditory feedback are important for synchronization, indicating a crucial role for interpersonal rhythmic entrainment (Knoblich et al., 2011). This rhythmic entrainment might even trigger bidirectional autonomic nervous system and brainwave frequency regulation. The rhythmical practices in the WTP could have strengthened the harmony-making process of MDC's biological rhythms. Besides, polyrhythmic motor function, and respiratory strength (Thaut et al., 2015), we believe ANS and emotion coregulation were also among this biological entrainment. Emotion coregulation, previously observed in dance-like rhythmic movements (Codrons et al., 2014) could have extended benefits beyond emotional stability (due to strong therapeutic alliance and deeper emotional experiences (Soma et al., 2020) to physical and motor performance. WTP's caring and nurturing techniques should be regarded in the light of the effects of prosocial behaviors on an individual's natural development and their social

interactions (Olivo et al. 2021). MDC might have enjoyed movement synchronization as a practice of entrainment and non-verbal communication. In addition, the stimulation of other awareness and elimination of broken connections in public life during long WTP hours could be correlating with empathy and social adaptability.

Besides, the continuous role shifts could have fulfilled the need for social interactions in WTP. The role shift, i.e. giving and receiving the techniques, is likely to be an excellent opportunity for social, language and motor skill integration considering the feedback provided in different forms. The after practice feedback requires starting a conversation, eye contact, awareness of personal boundaries, taking turns, sensitive topics, active listening/interrupting, trying to understand emotions and body language, and even ending the conversation. This interaction could have helped MDC improve engagement, communication, prompt response, expression, and posing questions considering the benefits of AI in ASD (Vonder et al., 2006).

WTP as Sensory Diet

WTP's non-verbal interaction via modified sensory input could have enhanced MDC's sensory processing, thus, sleep pattern which was confirmed by the mother. Lawson and Little (2017) have already indicated the link between sensory modification and sleep quality. This can be attributed to the increased ability to counteract hyperarousal or regulate arousal through the proprioceptive and tactile input provided in water (Lawson & Little 2017). However, a link between sensory modification and reduced sensory-seeking behaviors and better attention should be further investigated.

The WTP somatic experience might have fulfilled MDC's sensory needs which can help explain improved touch tolerance. Vonder et al., (2006) recommended aquatic activities in favor of touch tolerance among children with ASD. The WTP-related reduced stress and oppositional behaviors could have further improved MDC's social and educational progress. Therefore, WTP can provide further complementary therapeutic potential in clinical practices.

MDC's reduced stress may also be linked to the intense activation of the C-tactile afferents in the WTP. C-tactile afferents' tactile receptors in the skin facilitate a rewarding sensation of touch and transform the tactile input into an affective sense (Pawling et al., 2017). Considering the correlation between metacognitive awareness and emotional resilience (Ünver et al., 2022), we suggest quality touch-related emotional empowerment as a future ASD research focus.

WTP Care Elements

Maczkowiak et al. (2007) suggested an expansion of traditional movement therapy for psychotherapeutic benefits. The WTP movement forms with intimate and gentle care elements including unconditional acceptance might have promoted the expression of social emotions and the feeling of being valued as a whole. Our findings are in line with the reciprocity of emotions shown by Güeita-Rodríguez et al. (2021). The holistic and gentle approach in one-on-one WATSU practices could have fostered a sense of trust and further improved MDC's technical progress. Decreased uncertainty in WTP could have provided a sniff of trust, the feelings of being validated and understood. These feelings are linked to the perception of emotional well-being (Morelli et al., 2014). MDC's improved eye contact could have reflected improved social emotions in his daily life. In addition, modelling and guidance as critical WTP elements might have further empowered social skills and eye contact in line with the study results by Chu and Pan (2012). Thus, the sense of being accepted, trusted and connected through the WTP could have alleviated MDC's feelings of estrangement and separation. Considering the study of Zanobini and Solari (2019), the WTP's warm water environment might have formed a mediation of communication that boosted positive feelings.

Default Mode Network & Mindfulness

The practice of focus on his own breath and the slow movements in WTP can be considered as tools for mindfulness. We believe these tools and even focus on the clients promoted MDC's mindfulness. Mindfulness, a promising tool for stress relief (Hofmann et al., 2010). Therefore, repetitive, breathing-based gentle and meditative WTP practices such as "distant stillness" induced mindfulness is likely to provide a broader brain activity, i.e. the brain's default mode network (DMN). DMN is activated during avoidance of external focus for a creative functioning, mindfulness and internal focus (Li et al., 2014). During the 5-day program, the WTP could have provided plenty of moments for the activation of DMN correlating with socio-emotional skills (Li et al., 2014). MDC's family and trainer reported a shift from solitude to prosocial activities. The successful engagement in one-on-one practices such as sharing, turn-taking, following rules, using names and problem-solving skills might have contributed to the prosocial activity tendency. Receiving the instructor's constant attention and observing the positive social interactions between the other participants in WTP may reflect the beneficial peer mediation helping MDC acquire certain social skills. Moreover, WTP's intensive adaptation effort could have been factors reducing MDC's stress reactions. In this regard, the improved social skills, self-worth, adaptive behavior, and a sense of accomplishment are linked to the adaptation and individualization (Chu & Pan, 2012; Pan, 2010). Considering the link between aquatics and social functioning (Reinders et al., 2019; Pan, 2011; Vonder et al., 2006), we recommend the use of WTP for its elements such as peer mediation, practice of social cues,

social empowerment and mindfulness moments to improve social functioning and participation in ASD.

WTP as a Shared Interest

Another tool to attenuate negative emotions is shared interest (Grandin, 2019). The WTP can be considered a form of shared interest that could have contributed to MDC's improvements in engagement, communication, socially acceptable interactions, and toleration of touch, eye contact, confidence and making friends. WTP structured teaching strategies provide social interaction, communication, emotional expression, turn-taking, and following the lead and instructions. Individuals with high-functioning ASD may be integrated into a non-ASD group with specific attention and awareness of other participants to work and be helpful. Thus, social skill acquisitions may be increased if a WTP is specifically designed for ASD. This integration may add benefits to the soothing nature and sensory diet benefits of a WTP.

Moreover, educational WTP can be an adjunct and complementary ASD therapy to provide benefits beyond the conventional treatment models. For instance, after achieving certain milestones in early intervention, WTP may provide continuity of therapeutic benefits for individuals with mild and high functioning ASD. The shared interest, and therapeutic non-verbal communication aspects of WTP can help maintain overall well-being. WTP induced gains in social and motor functioning might help reduce caregiver stress that correlates with caregiving outcomes (Lee et al., 2019).

WTP as Work Skills

Further, WTP skills can be potential work skills in ASD if approved by Worldwide Aquatic Bodywork Association and physicians. Although WTP is designed to train students and prepare them for certification as WATSU practitioners who work independently with the public, adults with ASD may practice under professional supervision. Therefore, the current study may be an ignition for future studies on gentle aquatic bodywork therapies for the development of work skill-related benefits in ASD.

Considering the efficacy, cost-effectiveness and therapeutic elements, we recommend WTP to enhance the well-being and quality of life of individuals with ASD. However, due to the limitations of our study and the nature of autism, larger randomized and controlled studies are needed.

Conclusions

Although the current study discusses MDC's improvement by gathering in-depth information from parents, the athletic trainer, and the WATSU instructor, there is a limitation in this study. Mainly, the generalization of our findings is limited due to the factors that might have influenced the results and interpretations. However, we can recommend the potential benefits of WTP for individuals with high-functioning ASD beyond being simply conventional movement therapy for depression (Maczkowiak et al., 2007).

WTP and other aquatic bodywork and therapy interventions should be investigated using robust design and standardized outcome measures with a varying student-teacher ratio. The visual cues, i.e. photos of each technique for visual orientation can be used to compare auditory and visually oriented WTP learning environments. For auditory learning-based WTP, visual inputs are decreased. Neurologic music therapy added to a WTP may be used to compare and analyze the coupling of biological oscillators.

Overall, the present study has implications for empowered social, emotional, behavioral functioning and technique acquisition as the first findings in the literature. Furthermore, WTP appears to be a promising social and educational program in ASD.

Competing Interests

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