South African Journal for Research in Sport, Physical Education and Recreation, 2021, 43(2): 59 - 68.
Suid-Afrikaanse Joernaal vir Navorsing in Sport, Liggaamlike Opvoedkunde en Ontspanning, 2021, 43(2): 59 - 68.
ISBN: 0379-9069

OBSERVATIONAL PRACTICE INTERVENTION FOR IMPROVING VISUAL SEARCH BEHAVIOUR, QUIET EYE AND MOTOR PERFORMANCE IN CHILDREN WITH AUTISM SPECTRUM DISORDER

Souri HEIDARI[1], Afkham DANESHFAR[2], Ali ABASSKHANIAN[3], Mahmoud SHEIKH[4], Brandon S. SHAW[5]

[1] *Department of Sport Sciences, Kish International Campus, University of Tehran, Kish Island, Iran*
[2] *Department of Motor Behaviour, Alzahra University, Tehran, Iran*
[3] *Department of Medicine, Mazandaran University of Medical Sciences, Sari, Iran*
[4] *Department of Motor Behaviour, University of Tehran, Tehran, Iran*
[5] *Department of Human Movement Science, University of Zululand, KwaDlangezwa, Rep. of South Africa*

ABSTRACT

Since autism spectrum disorder (ASD) is a neurological and developmental disorder that is considered a major emerging public health issue, this study investigated the effect of observational practice on visual search behaviour, quiet eye and motor performance in overarm throwing skills in children with and without ASD. Children aged 7-10 years with and without ASD were matched for gender and randomly assigned into an experimental group (EG) with children with ASD (n=10; 8 boys and 2 girls), control group (CG) with children with ASD (n=10; 7 boys and 3 girls); EG with children without ASD (n=10; 7 boys and 3 girls) or CG with children without ASD (n=10; 7 boys and 3 girls). While all groups were homogenous at pre-test, results indicated that both EGs that performed visual exercises were found to have significant ($p<0.05$) improvements in throwing accuracy, visual search behaviour and duration of quiet eye. No such improvements were found in both CGs at the conclusion of the study. Visual exercises could be a useful tool to improve motor learning in children with ASD in school- and physical therapy settings, and may be used to improve speech/language skills, and social communication skills in children with ASD.

***Keywords*:** Autism; Children; Developmental disorder; Observational practice.

INTRODUCTION

Movement disability and motor learning are considered as the most important problems in children with different types of disorders and diseases, such as cerebral palsy and autism, which are emerging public health issues (Smits-Engelsman *et al*., 2003; Shariat *et al*., 2014). Recently, there is increasing attentiveness about autism spectrum disorders globally, despite ever-increasing burden on public health. Autism spectrum disorder affects not only the child him or herself but also places a considerable financial and emotional burden on the caregivers and healthcare infrastructure of the country.

Autism spectrum disorder is defined by three problems, including a qualitative defect in socialisation, a defect in communication and language, repetitive and stereotyped movements, but their symptoms are not necessarily limited to the above (Fuentes *et al*., 2014; Cooper, 2020). Many studies have tried to suggest the best way to reduce the symptoms of this disorder, most of which are usually evaluated by methods, such as behavioural therapy, cognitive-behavioural therapies and stimulant drugs (Shariat *et al*., 2015; Lacivita *et al*., 2017; Scattone *et al*., 2018; Blank, 2019; Zhou *et al*., 2019). Other treatments, such as play therapy, relaxation training and non-stimulant medications, have also been considered (Barajas *et al*., 2017; Overley *et al*., 2018). However, due to the increased awareness of the side effects of drugs and medical interventions, greater emphasis is being placed on cognitive-behavioural therapies (Wood *et al*., 2020).

It is unequivocal that motor retardation negatively affects communication, language, cognitive development, perception, balance, appearance, social interaction and motivation to participate in social activities in children with autism spectrum disorder (Gregor *et al*., 2018). Further, disabled and impaired movements may interfere with opportunities for positive experience and social learning, and as a result, reduced opportunities for social interaction may lead to poor understanding in practice (Shaw & Shaw, 2014; Gregor *et al*., 2018;). Through intervention, improved motor approaches and motor function may be used to improve speech/language skills and social communication skills in children with autism spectrum disorder (Adams *et al*., 2004).

Many visual scenes contain more information than individuals can fully process all at once (Tsotsos, 1990). In these cases, visual attention is used to control the selection of the subset of the scene. Specifically, visual search is the mental and physical process of visual probing that allows the eye to have an opportunity to put an anomaly of interest into the active field of view. Interestingly, it appears that individuals with autism spectrum disorder display superior performance on tasks that produce difficult, apparently serial search, but not those that produce efficiently parallel search behaviour (O'Riordan *et al*., 2001). As such, it may prove an imperative to enhance visual search in individuals with autism spectrum disorder in an attempt to improve attentional control.

Research in motor behaviour has emphasised that there is a relationship between glare behaviour and motor performance, especially in skills such as aiming that require refinement of visual-motor coordination (Vickers, 2016). As such, quiet eye is a strong feature of perceptual proficiency. Quiet eye represents a specific glare behaviour prior to the onset of movement or motor response (Vickers, 2016) and represents a critical period of cognitive processing during which the components of the next response, such as force, direction, and velocity, are precisely programmed and adjusted (Ulrich *et al*., 1998). In various sporting tasks, longer durations of quiet eye have been observed in skilled performers when compared to beginners and unsuccessful performers (Vickers, 2016). Thankfully, recent advances in the production of vision tracking equipment have led to an increase in studies of how visual attention affects the performance of targeting tasks (Millard *et al*., 2020).

In terms of motor performance, novel skills may be learned from the outcomes of their own internally generated actions (experiential learning) or from the observation of the consequences of externally generated actions (observational learning) (Foti *et al*., 2019; Millard *et al*., 2020). Specifically, numerous studies have shown that visual learning can be a beneficial way to train motor skills in individuals without autism spectrum disorder (Jiang & Zhao, 2017; Hayes *et al*., 2018;). Also, research has pointed out that children with autism spectrum disorder can also

learn new skills through visual learning, as a cognitive-behavioural learning process, through the development of their visual learning treasury (Scarpa *et al*., 2017; Wood *et al*., 2020).

In this regard, most traditional teaching methods used in autistic children rely mainly on auditory instruction (Tissot & Evans, 2003). However, autism is a spectrum disorder, and not all children with autism spectrum disorder benefit from copious oral instruction during traditional classroom teaching approaches (spoken teacher instruction directing child activity) (Tissot & Evans, 2003). Although a child may have difficulty associating meaning with verbal instructions. In addition, this is not necessarily true of instructions that take a more visual form (Tissot & Evans, 2003). This lack of benefit from oral instruction is also linked to the lack of ability to derive meaning from spoken words, leading to severely limited, or even no, spoken language. On the other hand, research has indicated that children with autism spectrum disorder may have a special advantage with regard to visual abilities (Dimolareva & Dunn, 2020).

This may make observational learning, as a cognitive-behavioural method, critical in improving visual search behaviour, quiet eye and motor performance in children with autism spectrum disorder. While such interventions have been undertaken with much success in children without autism spectrum disorder (Hebert, 2018), little or no research exists for the efficacy of such interventions in children with autism spectrum disorder. This is problematic in that improved motor approaches and motor function may be used to improve speech/language skills, social communication skills, language, cognitive development, perception, balance, appearance, social interaction and /or motivation in children with autism spectrum disorder. Such motor approaches may also provide an additional opportunity for qualified physical educators and human movement science specialists to complement existing proven management strategies, either in a school, home or clinician-based setting.

PURPOSE OF STUDY

The present study aimed to investigate the effect of observational practice on visual search behaviour, quiet eye and motor performance in overarm throwing skills in children with and without autism spectrum disorder. The primary outcome of this study was motor performance of children that was determined by throwing accuracy. Visual search behaviour and duration of quiet eye were the secondary outcomes of this study.

METHODOLOGY

Research design

This study is a longitudinal pretest-posttest study with four gender-matched and randomised groups. This was a single blind study, as only the assessor was blind to the participants.

Participants

The permuted block randomisation method was used to randomly assign the participants into an experimental group (EG) for children with autism spectrum disorder (n=10; 8 boys and 2 girls), control group for children with autism spectrum disorder (n=10; 7 boys and 3 girls), experimental group for children without autism spectrum disorder (n=10; 7 boys and 3 girls) or a control group for children without autism spectrum disorder (n=10; 7 boys and 3 girls).The sample size was defined using the G*Power 3.1 the current power of 0.80, α=0.05. Twenty children without autism and 20 with autism spectrum disorder aged 7 to 10 years from primary

schools and autism rehabilitation centres were randomly identified for participation in this study (Figure 1).

Prior to participation in the study, all participants had to meet the following inclusion criteria: diagnosed with level 1 autism spectrum disorder, right-handed, have no mobility, vision or hearing problems, understand and be able to follow the instructions provided by the researcher and have sufficient motivation and enthusiasm to perform skills and interventions.

Interventions

At the start of the experimental procedure, each participant was instructed on how to perform correctly an overarm throw by a skilled demonstrator. To ensure they learned the basic pattern of movement, each participant performed the desired throwing skill, using a standard tennis ball, five times without scoring points. The Spectacle Tracker Glasses (model ORB523, Orbit, China) were then placed on each participants' eyes, and the device was calibrated and the angle, and shooting speed adjusted accordingly. All participants then performed an overarm throw 10 times, with a break of one minute between each attempt. Each score was recorded, as well as the staring (quiet eye or last stabilisation before bending the elbow). This was followed by the participants watching a video (https://kiddo.edu.au/skills/overarm-throw) using a 61-inch rear projection television (JVC HD61FN97, Kanagawa-ku, Yokohama, Japan) with internet connectivity demonstrating an overarm throw 10 times. Visual search behaviour was recorded while watching the video.

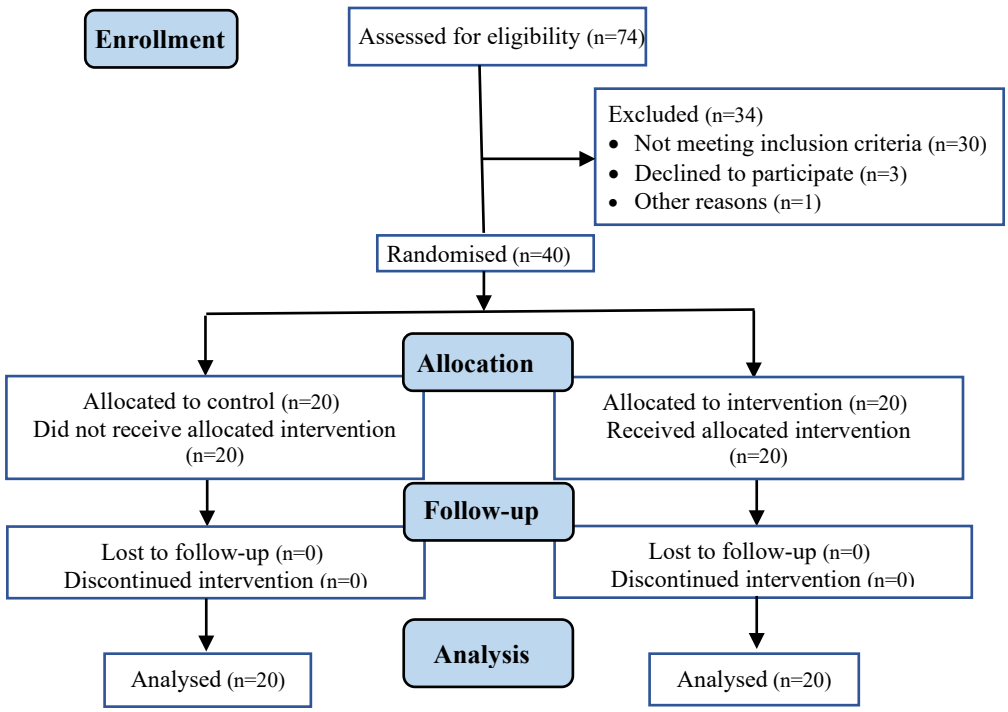

Figure 1. **PARTICIPANT FLOW DIAGRAM**

The EG participants (with autism spectrum disorder and without) watched visual exercises performed by a skilled demonstrator for three consecutive days and performed three sets of 10 repetitions of overarm throwing, using a standard tennis ball. Similar to the pre-test, the information related to the result of movement and stare (quiet eye and visual search behaviour) was recorded using the Spectacle Tracker Glasses (model ORB523, Orbit, China). The CG participants (with autism spectrum disorder and without) did not receive any such training and continued their usual activities for the duration of experimental period.

Ethical considerations

Written approval was obtained from the primary schools and autism rehabilitation centres. In addition, written informed consent was obtained from the parents and/or legal guardians, while assent was obtained from the participants themselves. This study was approved by the relevant institutional ethics review board at the University of Tehran, Iran (IR.SSRC.REC.1398.016) and was conducted in accordance with the principles of the Declaration of Helsinki. All the procedures were conducted under supervision of the same physician and a psychologist.

Data analysis

Statistical analyses were performed using the Statistics Package for Social Sciences (SPSS v16; SPSS Inc., Chicago, Illinois, USA). All data are presented as mean±standard deviation (SD). Normality was checked for each variable using the Shapiro-Wilk test. T-tests were utilised to establish if any differences existed in the measured variables in the various groups from pre- to post-test. Cohen´s d was used to determinate the effect size (the value of 0.1 for small effect, 0.3 for medium effect, and 0.5 for large effect). P-values equal to and less than 0.05 were considered as significantly different.

RESULTS

At pre-test, no significant ($p<0.05$) differences were found between the experimental and control groups and these groups can be considered homogenous.

The results of the paired t-test demonstrated that in the experimental group with children with and without autism, visual exercises led to a significant increase in the accuracy of overarm throwing skills (from 56.00±1.53 to 67.80±8.49 throws; p=0.020 and from 67.10±1.38 to 75.50±1.13 throws; p=0.001, respectively), duration of records (from 15329.10±1296.97 to 17750.70±1310.01m.sec^{-1}; p=0.001 and from 14544.10±881.93 to 20545.70±862.29m.sec^{-1}; p=0.001, respectively), number of records (from 24.60±2.79 to 26.40±1.95; p=0.001 and 29.80±2.97 to 31.30±2.83, p=0.012, respectively) and duration of quiet eye (from 238.14±104.18 to 366.52±121.91 m.sec^{-1}; p=0.010 and 460.03±181.52 to 1043.42±756.14m.sec^{-1}; p=0.001, respectively) (Table 1).

However, no significant ($p>0.05$) change was found in the CGs with children with and without autism in the accuracy of overarm throwing skills (from 53.10±1.02 to 55.00±1.40 throws; p=0.091 and from 78.30±1.23 to 79.10±1.18 throws; p=0.072, respectively), duration of records (from 17446.40±1339.61 to 17619.50±1493.77 m.sec^{-1}; p=0.115 and from 15071.30±1163.69 to 15492.80±1175.34 m.sec^{-1}; p=0.731, respectively), number of records (from 26.00±2.82 to 26.70±3.19; p=0.130 and from 30.20±3.25 to 30.30±5.47; p=0.310, respectively), and duration of quiet eye (from 249.80±88.77 to 251.37±71.37m.sec-1; p=0.143 and from 604.72±180.67 to 609.27±548.27m.sec-1; p=0.82 respectively) (Table 1).

Table 1. **OBSERVATIONAL PRACTICE INTERVENTION AND VISUAL SEARCH BEHAVIOUR, QUIET EYE AND MOTOR PERFORMANCE**

Variable	Group	Time	Within-group comparison		Between-group comparison		Effect size between groups
			With autism (n=20)	Without autism (n=20)	With autism (n=20)	Without autism (n=20)	
Overarm throwing skills	Experimental (n=10)	Pre-test Post-test	0.020*	0.001*	0.001*	0.001*	0.50
	Control (n=10)	Pre-test Post-test	0.091	0.072			
Duration of quiet eye	Experimental (n=10)	Pre-test Post-test	0.010*	0.001*	0.002*	0.012*	0.60
	Control (n=10)	Pre-test Post-test	0.143	0.820			
Duration of records	Experimental (n=10)	Pre-test Post-test	0.001*	0.002	0.001*	0.001*	0.58
	Control (n=10)	Pre-test Post-test	0.160	0.630			
Number of records	Experimental (n=10)	Pre-test Post-test	0.001*	0.012*	0.001*	0.001*	0.63
	Control (n=10)	Pre-test Post-test	0.130	0.310			

* Significantly ($p \leq 0.05$) different

DISCUSSION

The present study aimed to investigate the effect of observational practice on visual search behaviour, quiet eye and motor performance in overarm throwing skills in children with autism spectrum disorder. Moreover, this study aimed to compare these effects in children without autism spectrum disorder. In this regard, the findings of this study demonstrate that visual exercises were found to have a positive effect on the accuracy of overarm throwing of children with and without autism. These findings are also supported by previous studies that investigated the effects of various methods of visual learning on children's motor skills with normal and impaired development, most of which have shown positive effects on visual learning (Breslin, 2009; Clare *et al*., 2018).

Social learning theorists emphasise that learning is beneficial and effective through observing a pattern and causes representation of the task (Wang *et al*., 2017; Duvall, 2020). Hypothetical mechanisms acquired through observation are no different from those developed during physical exercise involved in learning (Bandura, 1986). Therefore, it has been suggested that visual learning and physical learning may be acquired through similar cognitive processes (Adams, 1971).

The results of this study with regard to visual search behaviour demonstrated that visual exercises increase the duration of visual stabilisation and, more importantly, identify more effectively appropriate areas for visual learning. In this regard, the visual exercises increased the number and duration of visual stabilisation in the main areas (ball and ball throwing path) when compared to the less important areas (body) in the experimental groups with children with autism and without autism. According to the direct perception theory, individuals directly perceive the external environment by stimulating the retina (Cook *et al*., 2012; Palmer *et al*., 2015) and improves learning when considering the external signs of the observational model.

As such, Al-Abood *et al*. (2002) observed that the group performing basketball free throwing focused on external signs (the path of throwing the ball to the ring) compared to the group whose dynamic skills (motion shape) looked at the observation model and had superior motor performance and visual search (Al-Abood *et al*., 2002).

It is argued that directing visual attention to the effects of the movement of the displayed model would enhance the achievement of the goal, freeing the degrees of freedom for self-organisation. In addition, it has been shown that the processes of perception and action are functionally related to each other, so that perception guides the environment of action, and on the other hand, action is a means of gathering information for perception. As such, perception and action seem to occur simultaneously (Kugler & Turvey, 2015). Thus, the improvement in visual search behaviour following the prescribed visual exercises in this study, promotes the achievement of the goal, releasing the degrees of freedom for self-organisation which may, in turn, guide the visual attention of the displayed model movements (Bernstein, 1966).

This study also found an improvement in quiet eye following visual training. These results suggest that three sessions of visual exercises increases the time of the quiet eye of children with and without autism during overarm throwing. Research has indicated that longer quiet eye duration develops vital planning throughout the parameter movement of direction and force. Therefore, the longer duration of this component provides the motor control system with information about the target position and makes the kinematic pattern and muscle activity pattern effective for successful skill execution (Vickers, 2016). Although the present study is the first to examine the effects of visual exercises on stare control. Visual exercises, such as visual-motor exercises, appear to facilitate parameterisation or motor control (Horn & Williams, 2004) and ultimately improve performance by increasing eye rest time in individuals with low stamina levels, such as children with autism spectrum disorders.

Since the findings of this study demonstrate that visual exercise results in improvements in throwing accuracy, visual search behaviour and duration of quiet eye in children with autism spectrum disorder. This practice may prove to be a tangible public health strategy to improve motor learning, movement and/or motor control in children with autism spectrum disorder. In addition, this strategy may prove a cost-effective and time-efficient method when compared to traditional oral instruction approaches.

However, it must be cautioned that previous studies have demonstrated that children with autism spectrum disorder reproduce incorrect movements of a demonstrator or actor due to their marked tendencies to hyper-imitate (Foti *et al*., 2014). This necessitates that health professionals make use of skilled demonstrators or visual aids that demonstrate only correct actions or tasks (Millard *et al*., 2020). Furthermore, it may prove invaluable, especially in school-settings, to make use of a sport, which is already applicable in that school. It is for these reasons that qualified physical educators and human movement science specialists be trained as coach learners with autism spectrum disorder.

CONCLUSION

The findings of this study demonstrate that visual exercise results in improvements in throwing accuracy, visual search behaviour and duration of quiet eye in children with autism spectrum disorder. Furthermore, according to the present study's findings, it appears children with autism spectrum disorder are as efficient as typically developing children in learning by observation. Thus, observational practice may prove to be a tangible public health strategy to improve motor learning, which in turn, may lower the public health burden by facilitating improvements in

motor control and concomitant improvements in speech/language skills, social communication skills, language, cognitive development, perception, balance, appearance, social interaction, and /or motivation in children with autism spectrum disorder.

Conflict of interest

No potential conflict of interest was reported by the authors.

REFERENCES

ADAMS, J.A. (1971). A closed-loop theory of motor learning. *Journal of Motor Behaviour*, 3(2): 111-150.

ADAMS, L.; GOUVOUSIS, A.; VANLUE, M. & WALDRON, C. (2004). Social story intervention: Improving communication skills in a child with an autism spectrum disorder. *Focus on Autism and other Developmental Disabilities*, 19(2): 87-94.

AL-ABOOD, S.A.; BENNETT, S.J.; HERNANDEZ, F.M.; ASHFORD, D. & DAVIDS, K. (2002). Effect of verbal instructions and image size on visual search strategies in basketball free throw shooting. *Journal of Sports Sciences*, 20(3): 271-278.

BANDURA, A. (1986). National Institute of Mental Health. Social Foundations of Thought and Action: A Social Cognitive Theory. Englewood Cliffs, NJ: Prentice-Hall.

BARAJAS, A.O.; AL-OSMAN, H. & SHIRMOHAMMADI, S. (2017). A serious game for children with autism spectrum disorder as a tool for play therapy. In *Proceedings of 2017 IEEE 5th International Conference on Serious Games and Applications for Health (SeGAH* (pp. 1–7). 1-4 April, Perth, Australia: IEEE.

BERNSTEIN, N. (1966). *The Co-Ordination and Regulation of Movements*. New York, NY: Pergamon Press.

BLANK, C.A. (2019). *Early childhood music therapy and autism spectrum disorder*. Philadelphia, PA Oxford University Press.

BRESLIN, C. (2009). Effects of visual supports on the performance of the Test of Gross Motor Development by children with autism spectrum disorder. *Adapted Physical Activity Quarterly (APAQ)*, 28(4): 342-353

CLARE, C.W.; WONG, S.W.L.; LO, F.S.F.; SO, R.C.H. & CHAN, D.F.Y. (2018). Study protocol: A randomised controlled trial study on the effect of a game-based exercise training program on promoting physical fitness and mental health in children with autism spectrum disorder. *BMC Psychiatry*, 18(1): Article 56. doi.org/10.1186/s12888-018-1635-9.

COOK, J.L.; BARBALAT, G. & BLAKEMORE, S-J. (2012). Top-down modulation of the perception of other people in schizophrenia and autism. *Frontiers in Human Neuroscience*, 6(June): Article 175. doi.org/10.3389/fnhum.2012.00175.

COOPER, L.J. (2020). An examination of executive functioning and restricted and repetitive behaviours in autism spectrum disorder. Unpublished doctoral dissertation. Phoenix, AZ: Grand Canyon University.

DIMOLAREVA, M. & DUNN, T.J. (2020). Animal-assisted interventions for school-aged children with autism spectrum disorder: A meta-analysis. *Journal of Autism and Developmental Disorders*, 50(9): 1-14.

DUVALL, R.M. (2020). The relationship between autism and the multiple intelligences theory: identifying patterns in learning for educational purposes. Unpublished honors thesis. Richmond, KY: Eastern Kentucky University.

FOTI, F.; MAZZONE, L.; MENGHINI, D.; DE PEPPO, L.; FEDERICO, F.; POSTORINO, V.; BAUMGARTNER, E.; VALERI, G.; PETROSINI, L. & VICARI, S. (2014). Learning by observation in children with autism spectrum disorder. *Psychological Medicine*, 44(11): 2437-2447.

FOTI, F.; PIRAS, F.; VICARI, S.; MANDOLESI, L.; PETROSINI, L. & MENGHINI, D. (2019). Observational learning in low-functioning children with autism spectrum disorders: A behavioural and neuroimaging study. *Frontiers in Psychology*, 9(January): Article 2737. doi:10.3389/fpsyg. 2018.02737.

FUENTES, J.; BAKARE, M.; MUNIR, K.; AGUAYO, P.; GADDOUR, N.; ÖNER, Ö. & MERCADANTE, M. (2014). Autism spectrum disorder. In J.M. Rey (Ed.), *IACAPAP E-Textbook of Child and Adolescent Mental Health*, (Chapter C2, 1-35). Geneva, Switzerland: International Association for Child and Adolescent Psychiatry and Allied Professions.

GREGOR, S.; BRUNI, N.; GRKINIC, P.; SCHWARTZ, L.; MCDONALD, A.; THILLE, P.; GABISON, S.; GIBSON, B. & JACHYRA, P. (2018). Parents' perspectives of physical activity participation among Canadian adolescents with Autism Spectrum Disorder. *Research in Autism Spectrum Disorders*, 48(3): 53-62.

HAYES, S.J.; ANDREW, M.; FOSTER, N.C.; ELLIOTT, D.; GOWEN, E. & BENNETT, S.J. (2018). Sensorimotor learning and associated visual perception are intact but unrelated in autism spectrum disorder. *Autism Research*, 11(2): 296-304.

HEBERT, K.R. (2018). Sensory processing styles and eating behaviours in healthy adults. *British Journal of Occupational Therapy*, 81(3): 162-170.

HORN, R.R. & WILLIAMS, A.M. (2004). Observational learning: Is it time we took another look? In N. Hodges & M. Williams (Eds.), *Skill Acquisition in Sport: Research, Theory and Practice (*1st ed.) (pp. 199-230). London, UK, Routledge.

JIANG, M. & ZHAO, Q. (2017). Learning visual attention to identify people with autism spectrum disorder. In *Proceedings of the IEEE International Conference on Computer Vision* (pp. 3267–3276). 22-29 October. Venice, Italy: IEEE.

KUGLER, P.N. & TURVEY, M.T. (2015). *Information, Natural Law, and the Self-Assembly of Rhythmic Movement*. London, UK, Routledge.

LACIVITA, E.; PERRONE, R.; MARGARI, L. & LEOPOLDO, M. (2017). Targets for drug therapy for autism spectrum disorder: Challenges and future directions. *Journal of Medicinal Chemistry*, 60(22): 9114-9141.

MILLARD, L.; SHAW, I.; BREUKELMAN, G.J. & SHAW, B.S. (2020). Factors affecting vision and visio-spatial intelligence (VSI) in sport: A review of the literature. *Asian Journal of Sport Medicine*. 11(3): e101670. doi:10.5812/asjsm.101670.

O'RIORDAN, M.A.; PLAISTED, K.C.; DRIVER, J. & BARON-COHEN, S. (2001). Superior visual search in autism. *Journal of Experimental Psychology: Human Perception and Performance*, 27(3): 719-730.

OVERLEY, L.C.; SNOW, M.S.; MOSSING, S.L.; DEGGES-WHITE, S. & HOLMES, K.P. (2018). Exploring the experiences of play therapists working with children diagnosed with autism. *International Journal of Play Therapy*, 27(1): 14-24.

PALMER, C.J.; SETH, A.K. & HOHWY, J. (2015). The felt presence of other minds: Predictive processing, counterfactual predictions, and mentalising in autism. *Consciousness and Cognition*, 36(November): 376-389.

SCARPA, A.; HASSENFELDT, T.A. & ATTWOOD, T. (2017). Cognitive-Behavioural Treatment for children with autism spectrum disorder. In C.A. Flessner & J.C. Piacentini (Eds.), *Clinical Handbook of Psychological Disorders in Children and Adolescents: A Step-by-Step Treatment Manual* (Chapter 16). New York, NY: Guilford Press.

SCATTONE, D.; SARVER, D.E. & COX, A.D. (2018). Parent-Child Interaction Therapy (PCIT): Autism Case Study# 4. In C.B. McNeil, L.B. Quetsch, C.M. Anderson, *Handbook of Parent-Child Interaction Therapy for Children on the Autism Spectrum* (pp. 651-664). New York, NY: Springer.

SHARIAT, A.; SHARIAT, A.; ABEDI, A. & MOHD TAMRIN, S.B. (2014). Physical activity as a prescription for the children with cerebral palsy. *Russian Open Medical Journal*, 3(1): Article no. 0108. doi.org/10.15275/rusomj.2014.0108.

SHARIAT, A.; GHAMARANI, A.; YARMOHAMMADIAN, A. & SHARIFI, T. (2015). Effectiveness of sand-therapy on the attenuation of separation anxiety signs in pre-school children. *International Journal of Kinesiology and Sports Science*, 3(1): 15-20.

SHAW, B.S. & SHAW, I. (2014). Determinants of physical activity in children and adolescents: mplications for the increasing prevalence of childhood obesity. *African Journal for Physical Health Education, Recreation and Dance*, 20(Supp 2): 91-101.

SMITS-ENGELSMAN, B.C.M.; WILSON, P.H.; WESTENBERG, Y. & DUYSENS, J. (2003). Fine motor deficiencies in children with developmental coordination disorder and learning disabilities: An underlying open-loop control deficit. *Human Movement Science*, 22(4-5): 495-513.

TISSOT, C. & EVANS, R. (2003). Visual teaching strategies for children with autism. *Early Child Development and Care*, 173(4): 425-433.

TSOTSOS, J.K. (1990). Analysing vision at the complexity level. *Brain and Behavioural Sciences*, 13(3): 423-469.

ULRICH, R.; LEUTHOLD, H. & SOMMER, W. (1998). Motor programming of response force and movement direction. *Psychophysiology*, 35(6): 721-728.

VICKERS, J.N. (2016). The quiet eye: Origins, controversies, and future directions. *Kinesiology Review*, 5(2): 119-128.

WANG, X.; LAFFEY, J.; XING, W.; GALYEN, K. & STICHTER, J. (2017). Fostering verbal and non-verbal social interactions in a 3D collaborative virtual learning environment: A case study of youth with Autism Spectrum Disorders learning social competence in iSocial. *Educational Technology Research and Development*, 65(4): 1015-1039.

WOOD, J.J.; KENDALL, P.C.; WOOD, K.S.; KERNS, C.M.; SELTZER, M.; SMALL, B.J. & STORCH, E.A. (2020). Cognitive behavioural treatments for anxiety in children with autism spectrum disorder: A randomized clinical trial. *Journal of American Medical Association (JAMA) Psychiatry*, 77(5): 474-483.

ZHOU, Y.; YIN, H.; WANG, M. & WANG, J. (2019). The effect of family-focused psychoeducational therapy for autism spectrum disorder children's parents on parenting self-efficacy and emotion. *Archives of Psychiatric Nursing*, 33(1): 17-22.

Corresponding author: Dr Mahmoud Sheikh; **Email:** rahmitawirza@yahoo.com

(*Subject editor: Prof Maya van Gent)*

.