Beery Visual Motor Integration Scores of Children with Autism Spectrum Disorder: Undergoing Occupational Therapy

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ABSTRACT:

Visual motor integration (VMI) is the ability to control hand movements through vision. Children with autism are at risk for VMI deficits although this correlation is well described in previous research not much else is known about the relationship between autism and VMI. This study investigated the potential predictors of VMI performance in children with autism. The impact of occupational therapy attendance, age, gender, and pre-Beery-Buktenica Developmental Test of VMI scores on post-Beery-Buktenica Developmental Test of VMI scores were analyzed. Secondary data from 104 subjects were analyzed using multiple linear regression. It was concluded that the pre-Beery-Buktenica Developmental Test of VMI score was the greatest predictor of the post-Beery-Buktenica Developmental Test of VMI score. Age and gender were not predictive. Occupational therapy attendance was not a significant predictor; however, there was a significant difference between pre and post-assessment scores. The findings of this study illustrate that children with autism who have VMI deficits can benefit from rehabilitation services, that all ages and both genders can expect similar positive outcomes, and that these positive changes were not limited by attendance. Professionals can utilize the predictive model to formulate realistic goals based on current VMI performance for both rehabilitative and school settings.

Keywords: pediatrics, Autism Spectrum Disorder, occupational therapy, Beery-Buktenica Developmental Test, Visual Motor Integration.

INTRODUCTION

Visual-motor integration (VMI) is the ability to perceive visual input, process the information, and coordinate a motor response (Rais-Bahrami & Lou Short, 2007; Schneck, 1996). VMI consists of visual perceptual and fine motor coordination skills (Cornhill & Case-Smith, 1996; Sanghavi & Kelkar, 2005). The ability to control hand movements through vision is necessary for a multitude of academic and non-academic endeavors including handwriting, keyboarding, and throwing and catching a ball. Deficits in VMI can negatively impact participation in meaningful activities and self-concept (Cornhill & Case-Smith, 1996; Kaiser et al., 2009). The previous research regarding VMI in children with developmental disabilities and the impact of occupational therapy is limited in both quantity and quality (Case-Smith, 2000; Dankert et al., 2003; Desai & Rege, 2005; Tanner et al., 2020). Additionally, there is no reference available denoting the expected changes in Beery VMI scores for children two to five years of age with a diagnosis of autism spectrum disorder (ASD). This current study bridged the gap in knowledge, providing valuable information for healthcare providers, educators, and families.

Children with ASD are at an increased risk for VMI deficits (Green et al., 2016; Miller et al., 2014; Wadsworth et al., 2017). Green et al. (2016) and Miller et al. (2014) both captured the diminished VMI performances in children with ASD while Wadsworth et al. (2017) described the neurophysiology that causes these discrepancies between typically developing children and children with ASD. This understanding of VMI was furthered to include gross motor implications (Bonifacci, 2004; Dowd et al., 2011; Englund et al., 2014). Bonifacci (2004) and Dowd et al. (2011) demonstrated the connection between motor abilities and VMI performance being related to the level of gross-motor abilities within the child and the ability to discern environmental cues to complete VMI tasks. Englund et al. (2014) indicated how the integration of different skills are distributed across brain regions, illustrating the reason why impaired motor abilities affect VMI performance.

Due to VMI deficits and other challenges (e.g., handwriting, communication, play skills, etc.), children with ASD may receive healthcare services to increase their engagement and participation in life roles (AOTA, 2014; Boyle et al., 2011). Children with ASD can attend speech-language therapy, physical therapy, occupational therapy, and applied behavioral analysis therapy to help reduce barriers to partaking in activities of daily living. Speech-language pathologists may address VMI to improve nonverbal communication skills (e.g., picture exchange communication system). Physical therapists may address VMI to improve gross motor coordination skills (e.g., catching a baseball). Occupational therapy may address VMI to improve fine motor coordination skills (e.g., typing). Applied behavioral analysis may address VMI to improve social-emotional skills (e.g., token board). Research has shown that rehabilitation services improve the performance of children with VMI deficits (Case-Smith, 2000; Dankert et al., 2003; Tanner et al., 2020).

Previous research has described the correlation between ASD and VMI deficits, but not much else is known about this relationship. This study addressed the gap in knowledge by investigating the potential predictors of VMI performance in children with autism. Specifically, this study examined the relationship between occupational therapy attendance, age, gender, and pre-Beery VMI scores on post-Beery VMI scores of children with ASD. The findings of this study can be used by healthcare providers, educators, and families alike to better understand the VMI performance of children with ASD.

METHODS

This study addressed the current gap in knowledge by investigating the relationship between occupational therapy attendance, age, gender, and pre-Beery VMI scores on post-Beery VMI scores of children with ASD. It answered the research question, "Does the total number of occupational therapy sessions a child attends during the six-month timeframe (occupational therapy attendance), age, gender, and pre-Beery VMI scores influence post-Beery VMI scores?"

A non-probability purposive sampling strategy was employed for the study. This sampling method was advantageous as this group of subjects within the pediatric outpatient clinic population represents children of a wider population (Cohen et al., 2017). Additionally, the sampling strategy permitted the selection of subjects who met the inclusion criteria (Martínez-Mesa et al. 2016). For instance, children who attended at least one therapy treatment session within six months with pre and post-Beery VMI scores were included in the secondary data analysis cohort study.

Data were obtained from one pediatric outpatient clinic in South Florida. Client charts of children aged two to five years of age with a diagnosis of ASD were reviewed. The data reviewed spanned from June 1, 2017, to March 13, 2020. Patient charts with pre and six-month-post Beery VMI scores who attended at least one therapy treatment session were included in the study. Occupational therapy attendance, pre-Beery VMI scores, and post-Beery VMI scores were recorded with relevant demographic information (e.g., age and gender).

RESULTS

A sample of 104 children was included for data analyses. The actual sample exceeded the necessary sample size calculated through G*Power (N = 85). The majority of subjects were male (male N = 83, female N = 21). The subjects' mean age was 49 months or approximately 4 years of age. On average, subjects attended 24 occupational therapy sessions within the 6-month timeframe. The average pre-Beery VMI raw score was 6 and the average post-Beery VMI raw score was 8.

The results indicated that the model was a significant predictor of post-Beery VMI scores, $F(4, 100) = 72.592$, $p = .000$. The results of the regression indicated that there was a high degree of correlation ($R = 0.862$). The model explained 74% of the total variation in the dependent variable for the sample population and an estimated 73% of the represented population.

Relating to the dependent variable (post-Beery VMI scores) there was a weak correlation to attendance ($r = -0.003$), age ($r = 0.046$), and gender ($r = 0.015$). There was a strong correlation between the pre-Beery VMI score ($r = 0.835$) and statistical significance between pre and post-scores. Additionally, no multicollinearity was noted between the independent variables. Pre-Beery VMI scores contributed significantly to the model ($B = .974$, $p<.20$); therefore, only pre-Beery VMI scores were included in the final predictive model. The final predictive model was as follows: post-Beery VMI scores = 1.558 + (.974 pre-Beery VMI scores).

DISCUSSION

The sample population for this study was adequate in size but had a large percentage of males. This was unsurprising due to the prevalence of ASD which predominantly occurs in males. Although the sample size (n = 104) was sufficient, this study's sample may not be representative of both genders. Future studies may try to recruit more female subjects when replicating this study.

The initial findings illustrate the severity of VMI deficits found in children with ASD. The average age of subjects was 49 months; with a 16-month disparity between their VMI score and age equivalence at evaluation. There were statistically significant improvements in their Beery VMI scores following 6 months of occupational therapy. These findings are congruent with past literature findings that intervention improves VMI performance (Case-Smith, 2000; Dankert et al., 2003; Desai & Rege, 2005; Tanner et al., 2020). Previously, Case-Smith (2000), Dankert et al. (2003), and Tanner et al. (2020) identified that occupational therapy interventions can enhance visual motor performance in preschool-aged children. Similarly, Desai and Rege (2005) found occupational therapy intervention to be effective for elementary-aged children. The findings from this present study adds to the growing body of evidence supporting the use of therapy to improve VMI performance.

Pre-Beery VMI scores were strongly related to post-Beery VMI scores and provide a reference for expected improvement for clinicians and key stakeholders. The average pre-Beery VMI score was ~6 (33-month equivalent) while the average post-Beery VMI score was ~8 (36-month equivalent). Based on the difference between the two averages, an improvement of approximately 2 raw points after six months of occupational therapy can be anticipated.

CONCLUSIONS

This study found that pre-Beery VMI scores are the greatest predictor of post-Beery VMI scores in children with ASD receiving occupational therapy services. The data illustrated the sometimes-profound VMI deficits in children with ASD and the potential impact of rehabilitative therapy. Healthcare practitioners should be aware of the potential VMI deficits in children with ASD and the possible benefits of rehabilitation. Occupational therapy practitioners should be aware of the relationship, in order to assess their interventions by meeting expected Beery VMI changes. Families and caregivers can be educated on anticipated outcomes. Based on the results, future research should focus on recruiting more females for replicated studies and causative prospective studies to address the influence of occupational therapy on Beery VMI scores.

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DECLARATION OF INTEREST STATEMENT

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