ORIGINAL RESEARCH

Visual-motor Integration: A Predictor of Oral Hygiene in Autistic Children

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ABSTRACT

Introduction: Visual-motor integration (VMI) is the ability of the eyes and hands to work together in smooth, efficient patterns. It involves visual perception and eye-hand coordination. The delay in motor skill acquisition by special children may lead to inability to perform tasks that need eye-hand coordination. Oral hygiene is significantly impaired among these children.

Aim: The aim of this study is to analyze correlation between the visual-motor skills performance and oral hygiene in children with autism.

Methodology: Eighty autistic children were randomly selected. VMI was tested using Beery and Buktenica Development Test. Patient's oral hygiene was measured using Greene and Vermillion's Oral Hygiene Index-Simplified. Data were collected and statistically analyzed.

Results: The overall VMI showed positive correlation ($P < 0.001$) with oral hygiene in these children.

Conclusion: VMI could be used as a predictor for oral hygiene in these children.

Keywords: Autistic, Oral Hygiene, Predictor.

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INTRODUCTION

Visual-motor integration (VMI) is the ability of the eyes and hands to work together in smooth and efficient patterns.[1] It involves visual perception and eye-hand coordination. Visual-motor skills require the ability to translate visual perception into motor functioning and involve motor control, motor accuracy, motor coordination, and psychomotor speed. The delay in motor skills acquisition by special children may lead to inability to perform daily routine tasks that require gross and fine motor coordination.

Autistic children have problems with sensory sensitivity and responsivity in the form of hypo- or hyper-reactivity for tactile, visual, and/or auditory information, VMI and now it is considered as a core feature of autistic child.[1] Dr. Leo Kanner's initial description of autism noted motor deficits describing the children as "somewhat clumsy in gait and gross motor performance."[1] Children with autism are susceptible to oral diseases such as dental caries and periodontal diseases because of the difficulty in mastering the skills required for routine tooth brushing.

Poor oral hygiene is significantly more prevalent in autistic children then their normal counterparts.[2] This percentage increases with age and correlates well with increasing levels of gingival inflammation.[3] An adequate oral cleansing of an individual is highly depended on mechanical aid like brushing. Proper tooth brushing is a simple motor activity that can promote oral health. Efficient tooth brushing depends on psychomotor skills, the child's hand function, and coordination of visual and motor skills.

Most commonly used standardized measures to assess VMI in autistic children is the Beery-Buktenica Developmental Test of VMI.[1] An explanatory correlation study was designed to analyze the correlation between oral hygiene and VMI.

Aim and Objective

The aim of this study is to analyze correlation between the visual-motor skills performance and oral hygiene in autistic children.

METHODOLOGY

The study protocol was approved by an ethical committee of the institute. Eighty autistic students aged 7–11 years were included in the study. The consents from the parents before the participation were given to their class teachers.

Inclusion Criteria

1. Children diagnosed as autism by a qualified professional
2. All students participated were free from disease or injury that could affect their upper extremity, dexterity, or strength.

Exclusion Criteria

Patients with diagnosis of cerebral palsy, mental retardation, neuromuscular disorders, and musculoskeletal disorders were excluded from groups.

Beery-Buktenica Developmental Test of VMI-six edition (Beery VMI-6) test was performed for hand motor skill. The booklet consists of geometric forms for three tests. All students used a standard HB pencil without an eraser. The students were given instructions about how to perform the test. The time required to complete the VMI was 10–15 min. Depending on their performance on VMI scale, scores were calculated. Scores were given to particular test according to the score card provided with the kit.

The oral hygiene was measured using Green and Vermilion's Oral Hygiene Index-Simplified (OHI-S) index. Score interpretation was done according to the procedure.

Data were collected and statistically analyzed.

RESULTS

Data were analyzed performing Chi-square test. Berry VMI was positively correlated with OHI with statistically significance of $P < 0.001$ value [Table 1].

Females are affected more as they are having more poor oral hygiene compared to males.

Regarding the data, analysis shows that VMI is independent from gender. The same trend was seen with OHI-S results also. Very low VMI was found more in male compared to female but not statistically significant. According to data, poor OHI-S was found more in female compared to male but not statistically significant.

DISCUSSION

Motor deficits are prominent in the presentation of children with autism. Deficits with temporal integration of multisensory information in these children have been considered as potential explanations for sensory and motor disturbances and their coordination. Children with autism showed worse performance in Berry VMI test compared to the typical children of 8–15 years in the study performed by Miller *et al*. in target school.[4] In the present study, 73.3% of children showed very low VMI performance which was noted considerably more in males than females. VMI has been found to be one of the most significant predictors of hand eye coordination performance and that more boys than girls tend to experience difficulties in hand motor activities.[4]

One of the most commonly used standardized measures of VMI is the Beery-Buktenica Developmental Test of VMI,[2] referred to as the Beery VMI. Although

Table 1: Evaluation of results in comparison with all parameters

		age	sex	Berry VMI (test 1) score	Berry VMI test interpretation	OHI-S	OHI-S interpretation
age	Correlation Coefficient	1.000	-.075	.009	.006	-.094	.059
	p value		.522	.941	.959	.421	.615
	N	80	80	80	80	80	80
sex	Correlation Coefficient	-.075	1.000	-.002	-.022	.059	-.090
	p value	.522		.987	.850	.618	.440
	N	80	80	80	80	80	80
Berry VMI (test 1) score	Correlation Coefficient	.009	-.002	1.000	.321**	-.029	.126
	p value	.941	.987	.954	.005	.808	.282
	N	80	80	80	80	80	80
Berry VMI test interpretation	Correlation Coefficient	.006	-.022	.321**	1.000	-.215	.511**
	p value	.959	.850	.005		.064	.000
	N	80	80	80	80	80	80
OHI-S	Correlation Coefficient	-.094	.059	-.029	-.215	1.000	-.569**
	p value	.421	.618	.808	.064		.000
	N	80	80	80	80	80	80
OHI-S interpretation	Correlation Coefficient	.059	-.090	.126	.511**	-.569**	1.000
	p value	.615	.440	.282	.000	.000	
	N	80	80	80	80	80	80

the Beery VMI has a rich tradition in assessing children and adults with various developmental disorders and acquired brain injuries,[2] remarkably few studies have examined Beery VMI findings in autistic children.

Berry VMI test comprised three individual tests. Test 1 was for combined visual and motor skill performance, in that child was asked to see and copy geographic shapes. Test 2 was for visual perception, which includes test to identify the difference between given shapes. Test 3 is for motor coordination, in which child is asked to join dots of given particular shape but keeping it in between the given plot.[1]

Kalyoncu and Tanboga and their study concluded, the children with autism had significantly higher bacterial dental plaque scores than children in the control group ($P < 0.045$).[5] The oral hygiene status of patients with autism was lower than that of unaffected patients.[5] Parents are not able to put in the necessary effort regarding oral health of these children due to restricted communication issues and increased sensory sensitivities of children with autism cause parents various difficulties in providing oral hygiene.

An explanatory study was carried out and which revealed highest OHI score among the autistic children group compared to mental retardation, Down's syndrome, and cerebral palsy.[6] In the present study, it was found poor oral hygiene in autistic children. These results are in agreement with the previous studies[6] which also reported high prevalence of periodontal disease in these individuals. These results may be related to the low physical abilities of these individuals, inadequate understanding of oral health management, problems in conveying oral health needs, anxiety of oral health procedures, and dependence on other people, such as parents or employees with assisted living services.[6] The previous studies[7] who observed increased occurrence of periodontal disease and poor oral hygiene in patients of Down's syndrome.

Kenney *et al*. found a significant positive correlation between oral hygiene scores and low VMI.[8] However, our findings revealed that compromised oral hygiene falls into autistic group. Shaw *et al*. concluded that children with autism had very poor oral hygiene and high levels of periodontal disease but these was not statistically correlated with visual and motor coordination.[9] However, the existing study showed that children with low VMI had poor oral hygiene with positive correlation and was statistically significant.

Effective brushing is considered as a most important aspect for maintaining good oral hygiene. Brushing is a voluntary physical activity, and as such has two requirements – motivation and physical (manual) ability. This may be even more in the autistic children in whom natural cleansing by the oral musculature is impaired.

Shaw *et al*. have shown that severely intellectually impaired children can have improved oral hygiene if encouragement and motivation are provided by guardians.[9] Pool and Jaffe have also demonstrated and evaluated the improvement in gingival health that can be obtained by instituting tooth brushing programs in special schools.[10] Authorities in dentistry have often failed to recognize that the best means of establishing good dental hygiene in the special child are not only through increased efforts and expertise of dental professionals in services provided but also through systematic instruction in self-care dental hygiene skills.

CONCLUSION

There is a need for incorporation of improved education and in-service training programs on oral hygiene practices. Our findings revealed that compromised oral hygiene falls into autistic group which could be correlated with VMI, thus can be used as a predictor of oral hygiene. Children with autism seem to need much more effort for providing oral care.

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