VISUAL-MOTOR INTEGRATION AND LEARNING DISABLED CHILDREN

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Abstract:

Objectives:

- To study and compare the performance of normal and learning disabled children (LD) on Beery and Buktenica’s Developmental Test of Visual-Motor Integration (DVMI).
- To provide occupational therapy intervention for improving visual-motor integration in the LD children and observe the effectiveness of therapy.

Methodology: Three groups were assessed on DVMI. Normal children (n=80) were assessed in groups. Experimental group and control group, each consisting of 16 LD children were assessed individually. Experimental group was given occupational therapy intervention in the department and supplementary therapy by parents, guided by therapist, regularly for 12 weeks. OT intervention included ergonomic factors, gross and fine motor activities. Control group was given counseling about OT program for 12 weeks. Post therapy, patients were re-assessed on DVMI and raw scores obtained were analyzed in order to examine the efficacy of OT program.

Results: It was found that normal Indian children aged 10 to 14 years attain mean raw score in DVMI at younger age than normal American Children. It was evident from DVMI raw scores that improvement in experimental group was more as compare to control group (P< 0.001). Thus occupational therapy has wide scope in treating learning-disabled children with the help of O.T. program.

Keywords: Visual-motor integration, Learning disabled, Developmental test of visual-motor integration.

INTRODUCTION

Visual Motor Integration (VMI) is the ability of the eyes & hands to work together in smooth, efficient patterns. It involves visual perception and eye-hand co-ordination. Visual-Motor skills require the ability to translate visual perception into motor functioning and involve motor control, motor accuracy, motor co-ordination and psychomotor speed.

Visual motor integration is an important variable to a child’s handwriting skills, particularly when copying or transposing from printing material to cursive or manuscript writing. There are various factors like visual-perceptual, motor planning, motor memory, sequencing etc for handwriting performance but Sovik found visual-motor integration was the most significant predictor of handwriting performance.

Many researchers have explained the importance of VMI in learning academic skills. Beery believes that before the child learns to write, the basic geometric shapes have to be mastered. It has been observed that as subject’s ability to copy the forms on the VMI increases, a concomitant increase in ability to copy letters accurately is seen, which was supported by Weil in his study. Mati-zissi observed that there is a correlation between performance in written language and drawing or design copying tasks. Failure on visual-motor tests may be caused by underlying visual-cognitive deficits including visual discrimination, poor fine motor skills, inability to integrate visual – cognitive and motor processes, or combination of these abilities.

The Berry’s Developmental Test of Visual Motor Integration (DVMI) has been extensively used in order to measure the integration problems in children. According to Berry, visual-motor integration is defined as the ability to copy geometric shapes. He suggested that the first nine figures in this DVMI should be mastered before a child learns to write. Subsequently many researchers have found high correlation of DVMI with writing readiness, handwriting skills, coping abilities, reading, mathematical abilities, academic...
performance in children. The deficits in VMI have been observed in learning disabled children. Since learning disabilities are closely associated with integrational problems, the reproduction of geometric forms may be a relatively sensitive measure of neurological integrity. Tranopol reports that 90% of learning disabled children has visual motor defects. Learning disabled children with poor visual-motor integration have difficulty in doing the fine activities like drawing geometric forms, cutting with scissors, copying design, pasting, coloring etc. Mattison analyzed the visual-motor problems of children with learning disabilities and found that they had significantly more trouble than normal children with design-copy tasks involving visual-motor components. Oliver found significant improvement in children’s writing readiness skill after giving occupational therapy intervention. It is evident from literature that learning disabled children do suffer from visual-motor integration deficit and occupational therapy intervention helps in remediation. Keeping in mind all these aspects, this study was conducted to explore the significance of VMI and effects of occupational therapy intervention on VMI in learning disabled children.

AIMS AND OBJECTIVE

- To study and compare the performance of normal and learning disabled children on visual-motor integration by using Beery and Buktenica’s ‘Development Test of Visual-Motor Integration’.
- To provide occupational therapy intervention for improving visual-motor integration in the learning disabled children and observe the effectiveness of therapy.

METHODOLOGY

This study used an experimental design where children aged 10 to 14 years were taken & divided into three groups. Group A consisted of normal children (N=80), group B was the Experimental group of LD children (N=16) & Group C was the control group of LD children (N=16). The subjects in ‘B’ & ‘C’ group were attending the LD clinic of the hospital. The instrument used for testing visual motor integration was 3rd edition of Berry’s Developmental Test of Visual Motor Integration (DVMI).

Group A:
The subjects for this study included 80 normal Indian children aged from 10 years to 14 years. This sample was selected from 5th to 8th standard of a private school. The school represented high as well as low socioeconomic strata and a variety of ethnic backgrounds. In an effort to obtain a sample of normal children, the teachers were instructed to exclude children with upper extremity impairment, visual impairment and learning disabled children.

PROCEDURE

The Subjects were tested in groups on DVMI. The booklet consists of 24 geometric forms. All subjects used a standard HB pencil without an eraser. The subjects were given instructions about how to perform the test. The time required to complete the VMI was 10-15 minutes. Depending upon their performance on visual-Motor Integration scale, scores were calculated.

Group B and Group C:
Experimental and control group consisted of 32 learning disabled children aged from 10 to 14 years representing from high as well as low socioeconomic groups and variety of ethnic backgrounds.

Inclusion criteria:
1. Children diagnosed as learning disabled by a qualified professional.
2. Learning disabled with Attention deficit hyperactive disorder.

Exclusion criteria:
Patient with diagnosis of Cerebral palsy, mental retardation, autism, neuromuscular disorders, musculoskeletal disorders were excluded from groups.

Procedure:
The authors with the help of parents filled a detailed proforma that included demographic data, family history, educational & developmental history. Perceptual & cognitive functions of the child were evaluated in details. The tests conducted by the psychologists such intelligence quotient was noted down. The DVMI Test was administered individually by therapist. Depending upon performance on VMI Test, scores were calculated.

Subjects from group ‘B’ & ‘C’ were referred to occupational therapy department for intervention. Children from the experimental group used to attend therapy once in a week. Supplementary therapy as prescribed by therapist was given by parents regularly at home. Children & parents of control group were given counseling about activities that can help to improve VMI. The therapist did not give formal training to this group in the department.

OCCUPATIONAL THERAPY INTERVENTION

Occupational Therapy intervention was given to group ‘B’ according to patient’s level of functioning and level of
performance on Development Test of Visual-Motor Integration. The therapy was individualized in the form that the children with severe deficit in VMI progress to complex activity at slower and gradual rate than children with milder deficit. Treatment was based on visual perception, Eye-hand co-ordination and Ergonomic factors.

The gross motor activities like overhead ball throwing, punching the suspended ball, drawing a line or circle on blackboard and building towers of blocks were given to LD children. To vary the sensory stimulation and to heighten interest and responsiveness, fine motor activities like beads stringing, clay modeling, mosaic design, cutting with scissors, joining the dots, coloring the figure, filling the missing part, abstract mazes and puzzles, draw part of alphabet in order to produce alphabet were given to LD children.

Ergonomic factors considered were as follows:

- Positioning: In positioning, shoulder girdle stabilization was emphasized. For right-handed patient, the paper was slanted to left side closer to midline and vice versa.
- Triangular plastic grip or broad padded holder for pen was given.

After 12 weeks of intervention both groups ‘B’ and ‘C’ were re-assessed on VMI test. The raw scores obtained were tabulated and analyzed in order to examine the efficacy of occupational therapy program.

**DATA ANALYSIS AND RESULTS**

Descriptive statistics including mean, standard error mean, standard deviation, ’t’ and ‘p’ value were computed on the basis of performance of subjects on VMI. The data were analyzed with SPSS statistical package.

The mean raw score on VMI test and corresponding age equivalent for 80 normal children were analysed as shown in table (1). When compared with the norms available in the manual it shows that the Indian children have obtained mean raw scores at a younger age as compared to their counterparts in North America.

Further the pre and post intervention raw score of the control and experimental group were computed (Table 2). It is observed that there is improvement in raw score in both the groups.

The Pre and Post intervention raw score of the experimental and control groups as percentage to the normal value done on VMI test was also analyzed (Table 3). This shows that there is improvement in raw score as percentage to normal value in both the groups.

A Comparison between the experimental and control groups pre and post intervention raw score on VMI test was done

<table>
<thead>
<tr>
<th>Chronological age group</th>
<th>Mean Raw score</th>
<th>Mean age -equivalent</th>
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</thead>
<tbody>
<tr>
<td>10-1 to 10-3</td>
<td>33</td>
<td>11-5</td>
</tr>
<tr>
<td>10-4 to 10-6</td>
<td>33</td>
<td>11-5</td>
</tr>
<tr>
<td>10-7 to 10-9</td>
<td>34</td>
<td>11-8</td>
</tr>
<tr>
<td>10-10 to 11-0</td>
<td>35</td>
<td>12-0</td>
</tr>
<tr>
<td>11-1 to 11-3</td>
<td>36</td>
<td>12-5</td>
</tr>
<tr>
<td>11-4 to 11-6</td>
<td>37</td>
<td>12-9</td>
</tr>
<tr>
<td>11-7 to 11-9</td>
<td>37</td>
<td>12-9</td>
</tr>
<tr>
<td>11-10 to 12.0</td>
<td>38</td>
<td>13-1</td>
</tr>
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<td>13-8</td>
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<td>42</td>
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<tr>
<td>13-1 to 13-3</td>
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<td>13-4 to 13-6</td>
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</tr>
<tr>
<td>13-7 to 13-9</td>
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<tr>
<td>13-10 to 14-0</td>
<td>45</td>
<td>15-7</td>
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<table>
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<tr>
<th>Group</th>
<th>Pre-intervention raw score</th>
<th>Post-intervention raw score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S.D</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>5</td>
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<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-intervention raw score as % of normal</th>
<th>Post-intervention raw score as % of normal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S.D</td>
</tr>
<tr>
<td></td>
<td>52.18</td>
<td>13.74</td>
</tr>
<tr>
<td></td>
<td>52.87</td>
<td>12.93</td>
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Table - 4
Comparison between the improvement in raw score on DVMI test in the experimental and control groups pre and post intervention.

<table>
<thead>
<tr>
<th>Improvement in Raw score</th>
<th>Mean</th>
<th>S.D</th>
<th>S.E</th>
<th>'t' value</th>
<th>'P' value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental Group (n=16)</td>
<td>6.06</td>
<td>2.08</td>
<td>0.52</td>
<td>9.703</td>
<td>0.000</td>
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<tr>
<td>Control Group (n=16)</td>
<td>0.75</td>
<td>0.68</td>
<td>0.17</td>
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</table>

Table - 5
Comparison between the improvement in raw score as percentage to normal value on DVMI test in the experimental and control groups pre and post intervention.

<table>
<thead>
<tr>
<th>Improvement in raw score as percentage to normal</th>
<th>Mean</th>
<th>S.D</th>
<th>S.E</th>
<th>'t' value</th>
<th>'P' value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental Group (n=16)</td>
<td>16.060</td>
<td>5.097</td>
<td>1.27</td>
<td>10.308</td>
<td>0.000</td>
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<tr>
<td>Control Group (n=16)</td>
<td>2.0383</td>
<td>1.903</td>
<td>0.47</td>
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</tbody>
</table>

Graph - 1
Pre and Post Intervention VMI mean raw score of Experimental and Control group

Graph - 2
Pre and Post Intervention VMI mean raw score of Experimental and Control groups as % of normal value

by using ‘t’ test (Table 4). Table (5) shows comparison between the improvement in raw score as percentage to normal value in the experimental and control groups pre and post intervention. Both the tables ‘p’ value being highly significant which supports that there is significant improvement in raw score in experimental group as compared to control group.

DISCUSSION

The results obtained show that normal Indian children attained means raw score on DVMI at younger age than normal American children (Table 1). The factors contributing to difference could be as follows:

**Fine prehension:** Use of fine prehension by Indian children is more than American children. E.g.: Eating with fingers instead of using spoon.

**Early exposure:** There is early exposure to activities involving hand functions like formal writing, paper and pencil task etc. in Indian children at 3 1/2 years as compared to western countries at the age of 5 years.

The analysis of pre and post intervention DVMI raw score
of the control and experimental group (Table 2, graph 1) and as percentage to normal value (Table 3, graph 2) show that there is improvement in raw score in both the groups. This means that both the groups benefited from therapy.

However, when performance of two groups was compared, the ‘t’ & ‘p’ value being highly significant supports the fact that improvement in experimental group was more than that in control group (Table 4 & 5, graph 3 & 4). These findings are consistent with that of Oliver who found that there was improvement in the performance of writing readiness skills in children following the sensorimotor occupational therapy program.3

Various factors may have contributed for this improvement. In experimental group, the unique element of occupational therapy program was its combination of direct therapy with an ongoing supplementary program. In this program, with therapist’s guidance and appropriate input, the child performed the activity in graded fashion and in correct way, which may not be possible by parents alone. Usually parents of LD children focus on academics goals, which may be monotonous while the program used in this study for the experimental group involved play activities having therapeutic values. The parents’ participation is important in the therapy to practice new skills but what is equally important is type of activities and rapport with child, which is provided by occupational therapist.

Georgia in her study supports motor learning theory and states that skills are developed through practice and feedback mechanisms.19 Current theories of motor learning support the notion that skills are developed through practice and feedback mechanisms that allow a generalized motor program to be developed for related skills.

Fisher has suggested that children with right hemisphere dysfunction have difficulty with visual-constructive and visual-spatial tasks.20 Hence, in the current study treatment was aimed at activating the right hemisphere through therapy activities like building blocks, puzzle etc.

It is evident from the literature that occupational therapy program is of utmost importance in dealing with VMI deficit in learning disabled. The present study provides further support for the value of occupational therapy program. Thus, in remediation of learning disabled children with VMI problem, the occupational therapy program has to be considered as valuable technique.

Another inference that can be drawn from this study is that DVMI needs to be standardized on larger Indian population before using it for screening and diagnostic purpose since Indian children attained mean raw score at younger age as compared to American children. However, one of the limitations of this study was that the randomization could not be done. Also, the group was not further divided into clumsy and non-clumsy children. That would have given further understanding about other factors such as fine motor skill deficits, or the dexterity problems which could be contributing or coexisting with the visual motor integration dysfunctions in LD children. Also, inclusion of a handwriting scale would have given insight into the correlation between visual motor integration & writing skills.

**CONCLUSION**

It can be concluded from the study that normal Indian children aged 10 to 14 years attain mean raw score on DVMI at younger age than normal American children. Hence there is need of standardization of DVMI on larger Indian population.

It was evident from the study that due to direct therapy, improvement in experimental group is more as compare to control group. In future, studies can be carried out to assess the long lasting effects of OT intervention after discontinuing the therapy and to find the co-relation between VMI and handwriting skills.

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**REFERENCES**


