Effects of visual perceptual intervention on visual-motor integration and activities of daily living performance of children with cerebral palsy

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Abstract. [Purpose] The purpose of this study was to find the effects of a visual perceptual intervention on visual-motor integration and activities of daily living performance of children with cerebral palsy as subjects. [Methods] This study was conducted with 56 children who were diagnosed as having cerebral palsy. The visual perceptual intervention was implemented for 8 weeks, 3 times a week, for 30 minutes per session, for a total of 24 sessions. All children were assessed using the VMI and WeeFIM to evaluate visual motor integration and activities of daily living skills, immediately before and after the 8-week intervention. [Results] The VMI and WeeFIM scores of all of the 56 children with CP who participated in the study improved, and the improvements were statistically significant. [Conclusion] Visual perceptual intervention had a positive influence on the visual-motor integration and activities of daily living performance of children with cerebral palsy.

Key words: Visual perceptual intervention, Visual-motor integration, Activities of daily living

INTRODUCTION

The incidence of cerebral palsy (CP) is showing a tendency to increase, and this means that the number of children with serious functional disorders are increasing. This increase has relevance for advances in medical technology and the preparation to provide social services and health for children with functional disorders.

Children with CP have accompanying perception disorders due to motor disturbance, the main disturbance, and disorders of the sensory organs, which receive environmental information, and disorders of the central nervous system, and it is well-known that the most general disorder is visual perception disorder. Children with visual perception deficiency show difficulties with wearing shoes, using clips, completing jig-saw puzzles, playing with toys and building blocks, color identification, and learning letters, all of which influence their daily living and general activities such as social participation.

With regard to visual perception ability, children with CP have difficulties with visual-motor integration. Visual-motor integration is the interaction of visual skill, visual perceptual skill, and motor skill. Efficient eye-hand coordination is necessary for successful performance of visual and spatial activities of daily living. The ultimate therapeutic aim for children with CP is to develop their potentiality as much as possible to allow full participation in home, school and the local community, and individual elements and environmental elements affect each other and are closely connected with the functional abilities of these children. The degree of impairment of movement of children with CP differs from individual to individual, so there is a wide range of levels of participation in activities of their daily living. The visual perception ability of children with CP is inferior to that of normal children, and it has been reported that this ability can be markedly improved by a visual perceptual training program. However until now, the study of visual perceptual training programs for children with cerebral palsy for the improvement of visual-motor integration and activities of daily living has been rare. Therefore, this study investigated the influence of a visual perceptual training program on visual-motor integration and activities of daily living of children with CP.

SUBJECTS AND METHODS

This study used pre/post-test design, and it was carried out at S hospital in a city of Korea in 2013. The subjects were children diagnosed as having CP by a rehabilitation medical treatment specialist and their occupational therapist.
performed the pre-test. The subjects were 56 children aged 4–7 years old (35 boys and 21 girls). Children whose parents did not give permission to participation in this study or who could not perform VMI according to directions of the tester were excluded. This study was approved by the Institutional Review Board of Inje University.

The intervention was performed for a total 24 sessions. Each session lasted for 30 minutes, during which three times a week for eight weeks. Each task was repeated two tasks were performed. In addition, more than two times to allow sufficient learning by the children. The place of intervention was a pediatric treatment room that was quiet and organized, and the visual perceptual training program was conducted by 3 occupational therapists with more than five years experience of pediatric treatment.

The visual perceptual training program comprised of 48 tasks, which were compiled by Yeo on the basis of a comprehensive training program for the development of visual perception, the Frostig Developmental Program in Visual Perception, proposed by Frostig. The contents of this program are 48 items such as visual-motor coordination, figure-ground perception, perceptual constancy and position in space and spatial relationship, and the order of training is comprehensively arranged according to the level of difficulty.

All the children were assessed using the Developmental Test of Visual-Motor Integration (VMI) and the Wee Functional Independent Measure (WeeFIM) immediately before and after 8-week intervention. VMI is a testing tool for visual-motor integration, which has structured test and grading standard. The test consist of 24 figures arranged by level of difficulty. WeeFIM is a tool for evaluating activities of daily living, and it is divided into six areas with 18 items of basic activities of daily living.

The data collected in this study were statistically processed using SPSS 18.0. Pre- and post-test results of VMI and WeeFIM were the raw scores of 2 occupational therapists with more than five years experience of pediatric treatment who followed the grading standards and grade lists of the testing tools. The raw scores of VMI were adjusted for the children’s chronological age (CA) and developmental quotient (DQ). To examine the improvement in ability of each individual, the pre- and post-test results were compared using descriptive statistics. The significance of differences was tested using the paired t-test. The level of significance for the statistics was chosen as 0.05.

RESULTS

The general characteristics of subjects are reported in Table 1. The changes in raw score, chronological age and developmental quotient of visual-motor integration are listed in Table 2. The raw score improved 5.28 points on average, the chronological age equivalent improved by one year, ten months and 2 weeks on average. The development quotient improved by 29.06 points on average. All of the improvements were statistically significant (p<0.05) according to the paired t-test.

The changes in activities of daily living of all of the children after completion of the visual perceptual training program are shown in Table 3. The WeeFIM raw scores were improved by 7.43 points on average by the visual perceptual training program, and the differences was statistically significant (p<0.05). There were progressive increases in subscores of self-care, mobility, communication and social cognition. The results of WeeFIM show the visual perceptual training program had a positive influence on the activities of daily living of all of the 56 children.

DISCUSSION

Visual perception disorders among children with CP causes numerous problems compounding of cognitive function and motor skills, and hinder the acquisition of new motor skills and independent performance of activities of daily

| Table 1. Demographic characteristics (n=56) |
| Variables | Number (%) |
|-----------|------------|
| Gender    |            |
| Male      | 35 (62.50%)|
| Female    | 21 (37.50%)|
| Age (months) |        |
| 48–59     | 12 (21.43%)|
| 60–71     | 32 (57.14%)|
| 72–83     | 12 (21.43%)|
| Gestational period (wks) | |
| 26        | 2 (3.57%)  |
| 27        | 6 (10.71%) |
| 28        | 16 (28.57%)|
| 29        | 8 (14.29%) |
| 32        | 24 (42.86%)|
| Type of CP |         |
| Spastic diplegia | 36 (64.29%) |
| Spastic hemiplegia | 20 (35.71%) |
| Use of assistive devices | |
| Cochlear implants | 6 (10.71%) |
| Glasses    | 37 (66.07%)|
| Lower limb orthosis | 29 (51.79%) |
| Wheelchair | 8 (14.29%) |
| None       | 14 (25%)   |
| CP: cerebral palsy | |

| Table 2. VMI raw scores, chronological ages, and developmental quotients with significance of differences between baseline and post-intervention (n=56) |
|-------------------------------------------------------------------------------------------------------------------------------------|
| Variables                              | Baseline Mean±SD | Post-intervention Mean±SD |
| Raw score                             | 5.79±2.89        | 11.07±3.17*               |
| CA (months)                           | 51.79±10.32      | 74.29±15.70*              |
| DQ                                    | 78.65±6.72       | 107.71±11.42*             |
| CA: Chronological Age, DQ: Developmental Quotient *Significant difference between baseline and post-intervention, p <0.05 |

Table 3. The WeeFIM raw scores were improved by 7.43 points on average by the visual perceptual training program, and the differences was statistically significant (p<0.05). There were progressive increases in subscores of self-care, mobility, communication and social cognition. The results of WeeFIM show the visual perceptual training program had a positive influence on the activities of daily living of all of the 56 children.

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Table 1. Demographic characteristics (n=56)
living such as standing erect, and disorientation. Impairment of visual perception ability can be an obstacle to the rehabilitation process.

In this study, a visual perceptual training program was conducted aiming to improve activities of daily living and visual-motor integration at a low level, and we examined its therapeutic effects on visual-motor integration and activities of daily living. The results demonstrate that the visual perceptual training program had a positive influence on visual-motor integration and activities of daily living. The conclusion of Parush et al. that visual perception and visual-motor integration are independent skills, but there is a significant correlation between them in clumsy children, is supported by the results of the present study.

We consider that a visual perceptual training program could be usefully conducted as a clinical method for functional recovery of visual-motor integration and activities of daily living, the essential elements for learning. Rehabilitation programs for children with CP should be appropriate for their ages and functional condition.

To establish the results of this study, it will be necessary for systematic study over long term involving many handicapped children, and studies of visual perceptual intervention stratifying the characteristics of handicapped children should also be performed.

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Table 3. WeeFIM raw scores and subscores at baseline and post-intervention with significant differences (n=56)

|                      | Baseline      | Post-intervention | p    |
|----------------------|---------------|-------------------|------|
|                      | Mean±SD       | Mean±SD           |      |
| Raw score            | 74.14±11.12   | 81.57±11.78*      | <0.05|
| Self-care            | 23.29±3.54    | 25.75±4.05*       | <0.05|
| Sphincter control    | 10.43±1.65    | 10.73±1.68        | <0.05|
| Mobility             | 13.86±2.68    | 14.29±2.61*       | <0.05|
| Locomotion           | 9.86±1.46     | 10.07±1.33        | <0.05|
| Communication        | 7.14±1.10     | 9.0±1.36*         | <0.05|
| Social cognition     | 9.57±2.06     | 12.07±2.16*       | <0.05|

*Significant difference between baseline and post-intervention, p <0.05