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Psychomotor Development in Pre-School with Visual Deficiency

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Abstract

Vision is a key for development, since it is animportant source of external reality, helping on spatial orientation. Congenital vision deficiency has been associated with developmental delay. The aim of this cross-sectional study is to describe the psychomotor and functional status of a sample of pre-school children with visual disorder. Children from a visual deficient school were invited to participate, and DENVER II and PEDI were the instruments used. Of the 14 children evaluated, only one had a complete normal DENVER II test on three of its four domains (fine motor-adaptive, language and gross motor abilities), and half had inadequate functional self-care according to PEDI. Visual deficiency interferes with child's psychomotor development, but functional status might not be proportionally affected.

Keywords: Visually impaired persons; Child development; Child; Preschool

Introduction

Neuropsychomotor development is dependent on the organization of the inputs to the nervous system, to build up functional abilities, behaviour and learning. Therefore vision is a key for development, since it is animportant source of external reality, helping on spatial orientation. Congenital visual deficiency has been associated with development delay in motor, emotional, educational, communication and social areas [1-4].

Research suggests that the mapping of sensorial inputs in the central nervous system is not innate, but occurs as a result of visual stimulation during ontogeny. This appears to act as the driving force for the creation of an external reference for multisensory integration and control of action [4].

According to the World Health Organization there are 161 million people with visual deficiency, most blinds live in underdeveloped countries (excluding China and India), 3.8 million in developing countries and 1.4 million are less than 15 years of age [5].

Early stimulation is the most recommended treatment for those children [1-4,6,7]. This method consists in evaluating the processes of development and stimulation that will theoretically facilitate the acquisition of motor and cognitive skills [6]. Despite numerous publications agreeing that this treatment is essential [1,2,7] rehabilitation professionals have great difficulty in finding research characterizing the specific gaps of this group of children so as to guide them during treatment. Within the physiotherapy this knowledge is important since the deficit of sensory integration may compromise the development [1,3,4]. Therefore the present study was conducted to evaluate the psychomotor development in visual deficient pre-school children on the DENVER II test and their functional status on PEDI.

Patients and Methods

The present is a descriptive study of pre-school children from Instituto Benjamin Constant (IBC) a school from the centre for visual disorders of Rio de Janeiro. Approval was granted from the IRB. All parents of the 21 children gave consent for their participation. Nevertheless four children left the school before being evaluated and three were unable to complete because of frequent absences. Therefore the final sample was of 14 children.

Denver Development Test II, the 1990 revised version of the original one published in 1967 was used. This test evaluates the psychomotor development of children from birth up to the age of six years in four different domains: (1) personal-social, (2) fine motor-adaptive, (3) language and (4) gross motor abilities [8].

In this test answers are obtained from questioning or from direct observation of child behaviour. A line is drawn on the score sheet according to the chronological age and all failed scores that fall to the left of this line are considered as a delay. Each item should be scored on a respective rectangle and are either considered approved, failed, not applicable or refused. Individual items should be interpreted as advanced, normal, cautious, delayed or not applicable. The whole test is then interpreted as either normal (if there are no failed scores at the left of the age line), suspicious (if there is one ore more failed scores at the left of the age line) or not testable [8,9].

Each child also had one of the parents answering the Paediatric Evaluation Disability Inventory (PEDI), a structured questionnaire to gather information on functional skills and disabilities. This instrument, standardized on a normative sample, measures capability and performance in self-care, mobility and social function and is used for children from six months to seven years of age. Dependency, and environmental adaptations are also captured. The obtained scores are transformed into normative scores according to a table. Normative scores below 30 are considered inadequate, being the worst possible result a value below 10. Similarly, we can transform the obtained scores in continuous scores, we then draw the maps of items for each child, which allows us to make an assessment regardless of age, to determine which items are most affected in each area [10].

Inclusion criteria

Subjects included in this study were children aged four to six, enrolled in IBC, therefore with visual disorder or blindness, whose parent could be available for the evaluation. The age range is based on the entrance age admitted at the pre-school (at least four years of age) and the ceiling for the DENVER II.

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Exclusion criteria

Were excluded from this study the children whose parents did not give consent and those who were unavailable to complete the tests.

Results

The 14 children evaluated (9 female and 5 male) were either five (35.7%) or six (64.3%) years old. Their visual disorder was congenital blindness in 10 (71.4%) and low vision in 4 (28.6%). Only three children (21.4%) had also another deficiency in addition to the visual disorder: autism (1), hemiparesis after car accident (1), seizures (1).

Many children had inadequate function status according PEDI (values under 30): 9 (64.3%) on self-care, 5 (35.7%) on mobility, and only 2 (14.3%) with associated deficiency had an inadequate social performance (Table 1).

Of those children with associated deficiency, the worst score in this evaluation was of the child that had autism associated to the visual disorder (normative score bellow 10 on all domains). The child with seizures had low scores in self-care and social performance (normative score bellow 10), while the one with hemiparesis had low scores in self-care and mobility.

Only two other children had scores bellow 10. One of those did not have previous rehabilitation (<10 in self-care and mobility) and the other had only low score in mobility but achieved scores above 30 in the other domains.

Looking at the maps of items in the area of self-care, tasks with more unfulfilled items were feeding, personal hygiene, and dressing. In the area of mobility tasks with more not performed items were locomotion tasks, with fewer failures in the transfer tasks. In the social area, the tasks with the highest number of not performed items were in the tasks of social interaction and home/community, with fewer failures in communication tasks, on the DENVER II all 14 children, even those without any other deficiency, were suspicious on the personal –social domain and only one child had normal result in all three other domains (fine motor-adaptive, language and gross motor abilities).

Some tasks clearly are vision dependent, but, even if those are supressed, the final results for the personal social and language DENVER II domains remain the same. As for gross motor function if the tasks requiring vision are eliminated (jump over an object) more children (9; 64.3%) would fall into a normal range, but only one more in the fine-adaptive domain.

Early rehabilitation, before school entrance was present in most of those children (11/14) for periods ranging from 18 to 48 months, most having started this therapy up to 2 years of age (Table 2).

Discussion

This sample of visual deficient pre-school children show that psychomotor development is markedly affected, but without such a great impact on functional status, where social was adequate and mobility less affected for children without associated deficiency.

Only two other studies were found on evaluation of children with visual disorder by PEDI. One is from Malta and colleagues (2006), in which the authors evaluated seventeen children with normal visual acuity and seventeen with visual disorder. This study showed that children with visual disorder had worse results than the seers in the three areas of PEDI, although the values of Social area don`t reach statistical significance.

The other study found was of Mancini et al. (2010). The authors evaluated 15 children with visual disorder and 15 with normal visual acuity of 2 and 6 years of age in the areas of self-care and mobility of PEDI. This study showed that 2 yearolds had less functionality than 6 year olds. In functional mobility skills, two year olds had lower performance compared to typical children of the same age, however, at six years of age these differences disappeared. In relation to the assistance provided by caregivers in the area of self-care, children with low vision in both ages received more aid, while in the mobility area the 6 year olds received the same amount of help given to a typical child of the same age.

However, in none of the studies, was mentioned which activities were deficient in each area, information vital for planning the treatment of these children. It is difficult to compare this study with those found in the literature, since we did not comparechildren with visual disorderwith those having normal visual acuity, but we can observe that, as well as Malta et al. [7], our children have a better functionality in the Social area.

Children	Visual Deficiency*	PEDI			Denver II			
		Self-Care	Mobility	Social Function	Personal-Social	Fine Motor-Adaptive	Language	Gross Motor Abilities
1	Low Vision	30,9	<10	32,0	suspicious	normal	normal	normal
2*	Congenital Blindness	47,2	53,6	38,0	suspicious	suspicious	suspicious	suspicious
3	**Congenital Blindness**	**19,2**	**56,3**	**38,9**	**suspicious**	**suspicious**	suspicious	suspicious
4	Congenital Blindness	33,6	37,6	54,3	suspicious	suspicious	suspicious	suspicious
5*	Low Vision	17,1	37,6	37,2	suspicious	suspicious	suspicious	suspicious
6	Congenital Blindness	21,4	56,8	48,8	suspicious	suspicious	suspicious	suspicious
7*	Congenital Blindness	<10	<10	30,9	suspicious	suspicious	suspicious	suspicious
8	Congenital Blindness	32,2	45,1	43,1	suspicious	suspicious	suspicious	suspicious
9	Low Vision	44,1	>56,8	61,8	suspicious	suspicious	suspicious	suspicious
10	Congenital Blindness	26,6	19,0	32,4	suspicious	suspicious	suspicious	suspicious
11	Congenital Blindness	14,4	56,8	48,8	suspicious	suspicious	suspicious	suspicious
12**	Low Vision	<10	<10	38,2	suspicious	suspicious	suspicious	suspicious
13***	Congenital Blindness	<10	56,3	23,9	suspicious	suspicious	suspicious	suspicious
14****	Congenital Blindness	<10	<10	<10	suspicious	suspicious	suspicious	suspicious

*Children with no Early Rehabilitation
**Child with hemiplegia
***Child with seizures
****Child with autism

Table 1: Results of the PEDI and Denver II tests.

Children	Age (in years)	Age of Onset of ER (in months)	Total Rehabilitation Time (in months)
1	6	36	24
2*	5	x	x
3	5	24	36
4	5	24	24
5*	5	x	x
6	5	1	48
7*	6	x	x
8	6	3	24
9	5	2	30
10	5	24	24
11	5	24	18
12**	6	12	36
13***	5	15	33
14****	6	18	30

*Children with no Early Rehabilitation
**Child with hemiplegia
***Child with seizures
****Child with autism

Table 2: Early Rehabilitation (ER) on the sample.

Analyzing our results on PEDI, we observe that the self-care domain was the functional area mostly affected. This might be attributed, besides the visual loss, to family over protection, not letting the child engage in activities without help. Feelings of mercy or pity are frequent for the child with visual deficiency and might lead to overprotection attitude that limit independency [11]. Another important factor is the simplification of the environment, where children are surrounded by simpler objects like shoes with Velcro and pants with elastic band, taking them the opportunity to experiment. Many parents justified their actions by lack of time, since letting their children do the tasks without assistance would take much longer.

Roder et al., [4] point that sensorial afferences are not inborn but built up as a consequence of stimulation to reach sensorial integration and motor control [4]. Practice and repetition should be therefore recommended.

Analyzing in two separate groups, those with early rehabilitation for more than 24 months with those with less, better scores for self-care domain are found in the first group. Of those children with less time of rehabilitation only one reached normal score. If this is a consequence of the rehabilitation, it has to be proved on a clinical trial. Unfavorable results may also be related to mirror neurons, since this is a trimodal system for motor action, and recognition that responds to visual, auditory and motor stimulation that help learning based on observation and imitation [12].

In the maps of items, personal hygiene tasks were mostly failed in putting toothpaste on the toothbrush and brush or comb the hair, tasks that require some practice time, especially if the child can not see the toothbrush or their reflection in the mirror. The tasks of dressing have several failed items, not having one that stands out. This may be due to the fact that parents and caregivers assist a lot in these tasks.

Mobility functional deficits on PEDI were present, according to the maps of items, for locomotion tasks, such as climbing bus steps, walking inside a bus in motion with its natural obstacles and walking on a street without supervision. Those are totally dependent on visual function, and one can expect that appropriate use of sticks and training codification of proprioceptive information could develop greater independency.

It is important to remember that mobility can be a challenging task for the visually impaired. In 1981, the International Year of Disabled Persons, the UN reported that "experience shows that it is mainly the environment that determines the effects of disability on a person`sdaily life." (UN, 1981).

Finally only two children had low scores in social function and those were children with other associated deficiencies. One could imply that family and school had achieved a great job in social integration, because nonverbal language is one important link with other people [13] and this is also visual dependent.

DENVER II test has not been developed for visual deficient children. Naming colors or figures, as well as motor tasks were vision most be used are only possible in non-visual impaired children [6,14]. But even if those visual items were not considered, the studied samples were lagging behind normal for age in personal-social, language and fine motor-adaptive domains. On personal-social domain the greatest difficulties were found on self-care tasks, so the same comments already exposed for PEDI could be repeated here.

In the gross Motor area most of the children had no or few failures, with difficulty only in those items which required balance that appears to be delayed. Our posture and movement is guided predominately through vision and proprioception, with some additional help from auditory and vestibular afference [6,14,15]. Therefore one would expect that balance and running would take more time to develop in visual deficiency children.

Finally, we can analyze the language area, which was the second in number of failures and would be the first if we exclude the visualitems. But, are visual deficient children really language impaired as indicated on DENVER II test? In this test at the age of 6 it is expected that children should be able to define 7 standardized words as banana, river, wall, and ball. It is hard for a child to define objects that have not been touched and explored with the hands, which is their major perceptive channel [6]. If an object has never been offered to be touched, or has never been described verbally it is not made knowledgeable for the visual deficient. Other language achievements attained by normal pre-school children as counting, attributing action to animals, location (on top, in front…) have also to be presented for experience in different ways for visual deficient children.

The main limitation for this study was the small sample. Although the instruments used to measure development and functional abilities were not constructed for visual deficient children, no specific validated instrument could be found. Perhaps some adaptation could be proposed and validated to be used in the future for those children in their development and functional achievements follow up without the drawbacks pointed in this sample.

It is important to remark that even with apparent developmental delay those children appear to have a good functional status. Health and school professionals should take this into account to explore and expect more improvement in those children with their intervention.

Conclusion

Visual deficiency interferes with child's psychomotor development, but functional status might not be proportionally affected. Associated deficiencies are a factor that may further impair performance in various tasks. Further studies should be conducted to assess the deficiencies in fine motor development, which occurs more significantly in the older ages, and to determine whether a specific training can improve performance in the area of self-care.

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