COORDENAÇÃO MOTORA E EQUILÍBRIO NÃO SÃO TOTALMENTE DESENVOLVIDOS EM CRIANÇAS CEGAS COM 7 ANOS DE IDADE

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RESUMO - As crianças portadoras de deficiência visual possuem dificuldades em conhecer seu próprio corpo, objetos a sua volta e parâmetros espaciais imprescindíveis para locomoção independente. Este trabalho analisa o desenvolvimento neuropsicomotor de um grupo de crianças com deficiência visual congênita em comparação a crianças com visão normal. Avaliamos dois grupos de crianças de sete anos de idade, através do exame neurológico evolutivo (ENE). O grupo estudado era constituído de 20 crianças cegas e o grupo controle constituído de 20 crianças com visão normal, pareadas por idade e sexo. Em algumas provas, as crianças cegas foram instruídas pelo tato. As crianças portadoras de deficiência visual tiveram pior desempenho nas provas que avaliaram o equilíbrio e coordenação apendicular, quando comparadas às crianças com visão normal (p< 0,001), sugerindo que o déficit visual compromete o desenvolvimento neuropsicomotor da criança.

PALAVRAS-CHAVE: deficiência visual, cegueira, desenvolvimento neurológico, exame neurológico evolutivo.

Balance and motor coordination are not fully developed in 7 years old blind children

ABSTRACT - Visually impaired children show difficulties in recognizing their own bodies, objects around then and the spatial parameters that are essential for independent movement. This study analyzes the neuro-psychomotor development of a group of congenitally visually impaired children as compared to children with normal sight. We have evaluated two groups of seven-year-olds by means of neurological evolution examination (NEE). The group studied comprised 20 blind children and the control group comprised 20 children with normal sight, and they were paired up according to age and gender. In some tests, the blind children were guided by touch. The visually impaired children performed worse in tests evaluating balance and appendage coordination compared to normal sighted children (p< 0.001), and this suggests that visual deficiency impairs children's neuro-psychomotor development.

KEY WORDS: visual impairment, blindness, neurological development, neurological evolution examination.

The human visual sense is as complex as speech, and it develops in a similar way. Sight is not an independent sense, and it is strongly linked to children's global motor activity, posture, skills, hand coordination, intelligence and personality. Thus, even negligible losses of sense or motor visual function are important for health care professionals working with these children[1,2].

Blind children need to integrate and synthesize data and information through other senses. They should be constantly and appropriately stimulated from an early age, which ensures that they evolve properly without any neuro-psychomotor development deficiencies[3,4].

A number of factors determine the development of posture control throughout life and sight plays an essential role in spatial orientation, which determines visually impaired children's motor behavior[3,5,6].

The most used strategy for rehabilitating visual impairment subjects (VIS) is "Early Stimulation", and this is also used with children who experience non-progressive chronic encephalopathy[4]. This method consists of evaluating the development process and stimulation that would, theoretically, make achieving motor and cognitive skills easier.

It has been seen that stereotype movements do not occur in blind children from African villages, where they are constantly being carried by adults[6].

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Visually impaired babies and children required greater labyrinth activity than normal sighted children do. Since they do not use sight to control posture, their walking ability becomes solely dependent on muscle-skeletal and labyrinth functions[7].

The aim of this study is to check neuro-psychomotor skills in seven-year-old congenitally blind children by means of a neurological evolution examination (NEE), which was standardized in Brazil by Lefèvre et al.[8].

METHOD

We applied NEEs on 40 seven-year-old children, 20 congenitally blind ones and 20 normal sighted ones.

Study group - The study group was made up of 20 congenitally blind children (7 boys and 13 girls) aged from seven to seven years and eleven months old, who were followed at the rehabilitation centers – "Instituto de Cegos Padre Chico –SP" [Padre Chico Institute for the Blind] and "CEPRE" (Study Center for Rehabilitation and Research) in Campinas, which specialize in blind children.

Control group - 20 normal sighted children, 9 boys and 11 girls, aged from seven to seven years and eleven months old from the school, "Colégio Nossa Senhora dos Remédios - SP". *Neurological Evolution Examination*. Static balance: feet together, on one foot, with knees bent at a 90º-angle, crouched position, balancing a ruler on the index finger; we have considered it a failure, respectively, when examinees interrupted the balance position or used their arms, put the other foot on the floor, did not keep the knees at a straight angle, fell down in the crouched position, when the ruler fell or when the other hand was used to help. Dynamic balance: jumping as high as they could, clapping twice; failure occurred when the children were not able to clap their hands while their feet were off the floor. Appendage coordination: copying a lozenge shape, (blind subjects used a drawing in relief); those who could not reproduce a diamond shape with its four distinct angles were considered to have failed. Rhythm reproduction: reproducing 6 rhythms made by the examiner (with intervals of 0.25 of a second for short ones and 1 second for long ones) made with the point of a pencil; examinees were considered to have failed when they were unable to reproduce 3 or more rhythms. We examined diadocokinesis and trunk-extremity coordination (from lying down to upright position) and finally, we tested motor persistence[8,9].

We used 12 neurological evolution examinations (NEEs) for the group of 7-year-olds[8]. Each child had the examination in only one session, in which the examinee performed up to two attempts of each test following the example given by the examiner. In order for the blind child to clearly understand the exercises, demonstrating it by using touch or speech was allowed, always making sure that the child had understood the exercise. Children who have hypotonia or hypertonia, areflexia or hyporeflexia were not included.

A statistical analysis was carried out using a chi-square test and a Fisher exact test. We considered significant p-values < 0.05. The study was approved by the research ethical committee from Uniban (Universidade Bandeirante de São Paulo (protocolo 3/2002), and all children were included after signing the consent form.

RESULTS

The tests were easily understood both by the study group children and the control group children. A higher failure rate was seen when tests were performed on the group of blind children (p< 0.001), when entire subset of tests carried out had been taken into consideration (Table 1).

The blind children performed worse in the static balance tests when the knees were bent at a 90º-angle (Table 2), in which 50% of them could not balance, as compared to only 10% of control group children (p<0.02).

Sixty-five percent of the blind children were unable to correctly reproduce a lozenge shape (Table 2) bur all the control group children were successful in this test (p<0.001).

DISCUSSION

Blind children performed worse in NEE tests when compared to normal children, basically as a

Table 1. Global success and failure evaluation of 40 children in all 240 tests carried out, according to study and control groups.

	Study group		Control group	
	N	%	N	%
Normal response	193	83.2	224	93.9
Failure	47	16.8	16	6.1
Total	240	100	240	100

χ^2 calc. Yates = 16.44* critical χ^2 = 3.84 p = 0.0001

Table 2. Observed result (success or failure) in each of the ENE tests in study and control groups.

	Study group (N=20)				Control group (N=20)				
	Failure		Success		Failure		Success		
Tests	n	%	n	%	n	%	n	%	p
EE feet together	1	5	19	95	0	0	20	100	NA
EE on one foot	9	45	11	55	5	25	15	75	0.32
EE knee flexion	10	50	10	50	2	10	18	90	0.02
EE crouched position	2	10	18	90	3	15	17	85	0.63
EE ruler on index finger	2	10	18	90	1	5	19	95	0.63
ED jump/clap	5	25	15	75	2	10	18	90	0.45
CA draw a diamond	13	65	7	35	0	0	20	100	0.001
CA repeat rhythms	1	5	19	95	2	10	18	90	0.63
Diadocokinesis	0	0	20	100	0	0	20	100	NA
CTM lying down/sit	4	20	16	80	2	10	18	90	0.66
PM mouth	0	0	20	100	0	0	20	100	NA
PM thumb	0	0	20	100	0	0	20	100	NA

Study group, blind children; Control group, normal sighted children; NA, non-analyzable; CTM, trunk-extremities coordination; EE, static balance; ED, dynamic balance; CA, appendix coordination; PM, motor persistence.

result of balance and appendage coordination difficulties.

Balance is the ability the keep the body orientated with relation to the external environment, and this depends on the continuous transmission of visual, labyrinth and proprioceptive information and on integrating these at the cerebral stem and cerebellum[1,10,11].

Acquiring neuro-psychomotor skills with regard to balance occurs, and should occur, during every moment of the continuous development of the human being. It is essential that basic skills be acquired early, when the size of the body does not put the subject at high risk of harm relating to overbalancing and when there is not yet too much psychological worry about the consequences of this. Blind children lack an important afferent system for correcting motor behavior, which makes it difficult to contact objects or situations that motivate behavior that requires balance[11,12].

Stability is closely related to the principles of balance and eye movements. Sight helps the body to orientate itself in space and indicates where the foot can be safely placed in order to achieve control, and blindness adversely influences a child's balance, which is why professionals from institutions specializing in blind children should direct treatment so that children may acquire this skill, without delay.

Balance was present in both groups when both feet were kept on the floor or when they were kept 5 to 10 cm off the floor. Blind children demonstrated proprioception in the first case, and they were positive about being close to the floor in the second case, which suggests that these factors were better performed by blind children. Sight is very important for balance skills; the accumulation of a space and time notion in children is directly related to the condition of moving and orientating with their own bodies, which occurs by trial and error. However, this may be impeded in visually impaired children, as a result of insecurity issues.

The major adaptation that blindness requires is that of converting the hand into a primary perception organ, without losing its performance function. The hand is used to locate, grab, recognize, take off, put on, open, close and pile up objects[13, 14]. The coordination of both hands is essential so that functions of perception and performance may be harmoniously carried out. Blind children's hands have to accomplish the double task of performance and perception. In spite of this specialization ability, blind children in our study did not perform well at the copying a lozenge test, which suggests that professional attention is needed to train skills of this nature. This is the basis of early intervention, since the purpose of the specialized professional who takes care of these children is complete neuro-psychomotor development, which, as far as possible, makes up for visual impairment[13,14].

Touch is one of the most stimulated systems in blind children, and it follows a similar learning course within the environment and develops in a similar way to their independence, as compared to normal sighted children. Learning to identify objects through touch requires a skill that is slow and not easy to acquire[15].

Normal sighted children are interested in the shape and color of objects, whereas blind children need stimuli to be close to their perceptive, tactile and kinesthetic field[13]. The sense of hearing helps blind children to understand and obtain information about their environment[16]. Normal sighted babies seek out objects mainly because they can see them. This skill is usually developed around the age of five months. Visually impaired babies spend a considerable amount of time locating objects, since they depend on sound clues, and do not start before the age of ten or eleven months[13]. The difficulty in seeking out objects is directly related to the notion of object permanence, which is an essential condition for recognizing outer reality as being a different entity and apart from oneself[14,17,18].

Awareness of neuroplasticity mechanisms and of several pathological processes has subsequently led to the development of new therapeutic procedures for patients presenting neurological disorders. Currently, such procedures aim at intervening in global functional tasks; however, working with the specific deficiencies of each patient enables skills to be accomplished faster and more efficiently[19].

We reached the conclusion that seven-year-old blind children demonstrate balance and appendage coordination deficiencies in NEEs, which is why we suggest including specific techniques for the development of these skills in the general treatment program, and this may result in better social integration and a better quality of life.

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