



Perceptual-motor abilities in pre-school preterm children



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ABSTRACT

Background: Several studies report a high percentage of premature infants presenting perceptual motor difficulties at school age. The new version of the Movement Assessment Battery for Children allows the assessment of perceptual-motor abilities in children from the age of 3 years.

Aims: To evaluate early perceptual-motor abilities in prematurely born children below the age of 4 years.

Study design: The Movement Assessment Battery for Children 2nd edition was administered to 105 low-risk prematurely born children (<32 weeks gestation) and in a control group of 105 term-born children matched for age and sex. All children were assessed between the age of 3 years and 3 years–11 months.

Results: 63 children (60%) had total scores above the 15th percentile, 15 (14.3%) had scores between the 5th and the 15th percentile, and 13 (12.4%) below the 5th percentile. The remaining 14 children (13.3%) refused to perform or to complete the test. The difference between preterm and control group was significant for total scores, Manual Dexterity and Aiming and Catching scores. In the preterm group there was a correlation between age at testing, total scores and Aiming and Catching subscores. The Movement ABC-2 subscores were significantly lower in children born below 29 weeks.

Conclusion: Perceptual-motor difficulties can already be detected on the assessment performed before the age of 4 years. Prematurely born children assessed between 3 years and 3 years–3 months appeared to have more difficulties in performing the test than the older ones or their age matched term-born peers. These findings support the possibility of a delayed maturation in the younger age group.

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1. Introduction

Several follow up studies of prematurely born children have previously reported perceptual-motor difficulties at school age [1–6]. The majority of these studies using the Movement Assessment Battery for Children, a test assessing manual dexterity, ball games and static and dynamic balance [1–6], showed that up to 60% of children born below the gestational age of 35 weeks had difficulties at school age.

No systematic study has so far been performed to identify earlier signs of perceptual-motor difficulties. While several papers have reported early neurodevelopmental findings using general scales or have explored specific aspects of neurodevelopment, such as visual motor, sustained attention, memory and language production below the age of 4 years [7–10], less has been reported on early perceptual-motor abilities. One of the reasons is that the original version of the Movement ABC [11], or its previous version, the Test of Motor Impairment, were developed for children above the age of 4 years [1–4]. The Movement ABC 2nd edition can be used in children as young as 3 years [12] and can therefore allow detection of earlier perceptual-motor difficulties. The test has recently been shown to be a reliable measure in a group of 3 year old children [13] and in 6 to 12 year old Taiwanese children with Developmental Coordination Disorder [14].

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The aim of this study was to evaluate possible signs of perceptual-motor difficulties in a cohort of low-risk children born prematurely assessed before the age of 4 years.

2. Methods

Study cohort: prematurely born children followed at the neonatal intensive care unit at Gemelli Hospital, Rome, Mangiagalli Hospital, Milan, and Stella Maris Institute, Pisa were assessed between February 2009 to May 2011.

Children were consecutively enrolled if:

- they were born between 25 and 32 weeks gestational age (GA) determined from first trimester ultrasound scans;
- cranial ultrasound scans were normal or only showed transient flares or germinal layer haemorrhages during the first 2 postnatal weeks and, at term equivalent age, showed no parenchymal abnormality and no evidence of atrophy i.e. no dilated ventricles (>14 mm Ventricular Index (VI)), irregular ventricular margins, widened inter-hemispheric fissure or enlarged extracerebral space [15];
- they were clinically stable by 35 weeks.

We excluded children with major congenital malformations, genetic chromosomal abnormalities, metabolic disorders, congenital infection or any sign of encephalopathy or seizures during their neonatal course, severe jaundice requiring phototherapy, and retinopathy of prematurity greater than stage 2.

In all, developmental quotient (DQ) at 2 years was evaluated with the Griffiths Mental Development Scales and neurological examination had been reported as normal at the age of 2 years.

All prematurely born children were assessed using chronological age and not corrected age as in our routine we use corrected age up to the age of two years.

Control group: we also assessed a control group of term born children (GA ≥ 37 weeks), matched for age and sex. All had a negative clinical history for neurological diseases. The control group was recruited from three primary schools in Rome and Pisa.

This study was approved by the Ethical Committee in each of the three Centers involved in the research. Parents of children in the pre-term and in the control group gave informed consent to the work.

2.1. Perceptual motor abilities

These were evaluated by using the Test component of the Movement ABC-2. The test includes three items assessing manual dexterity, two assessing aiming and catching and three balance.

Individual results can be compared and scored according to normative data available for each year and, within each year, for the first and the second semester (i.e. 3 years to 3 years–5 months and 3 years–6 months to 3 years–11 months). The test is designed to give a global score but the subscores for the three subscales can also be compared to age specific normative data.

All assessments were administrated by pediatric neurologists.

The results were scored in two ways:

First, we compared the scores of the prematurely born children with the normative data available from the manual. The results were scored as *normal* (when falling above the 15th centile), *borderline* (when falling below the 15th centile but above the 5th) and *abnormal* (when falling below the 5th centile). We also noted if the child refused to perform the test or part of it.

As the Movement ABC-2 has not yet been validated in Italy, the results were also compared with a control group of preschool children matched for age and sex.

ANOVA model was used to compare differences in the Movement ABC-2 results between prematurely born children and the control group. In prematurely born children the correlation between the

Table 1

Movement ABC-2 percentile scores in prematurely born children and in control group.

MABC-2 Percentile Score	Prematurely born children		Control group		p value
	Median	Range	Median	Range	
Total	32.76	0.5–99	52.17	2–100	p < 0.00001
Manual dexterity	30.16	0.5–98	58.65	5–100	p = 0.00002
Aiming and catching	32.95	1–99	45.17	0–100	p = 0.0276
Balance	41.30	0.5–99	48.56	0–100	p = 0.343323
Refusal	14		1		p < 0.00001

Movement ABC-2, age at testing time, gestational age and birth weight were also investigated using the Pearson correlation analysis.

Differences between groups were considered significant after correction for multiple comparisons (P corrected < 0.05).

Post-hoc analyses was conducted to qualify the nature of interaction (Tukey's Honest Significance Test), between subgroups of sampled populations.

3. Results

One hundred and five prematurely born children (43 males, 62 females) fulfilled the inclusion criteria and all agreed to participate to the study. Median gestational age at birth was 29.2 weeks, range 26–31 weeks. Median birth-weight was 1177 grams, range 480–2200 grams. Median chronological age at the assessment was 40.33 months, range 36–47 months.

All had normal DQ at 2 years and none had signs of cerebral palsy on neurological examination.

3.1. Movement ABC-2

When compared to the available normative data, 63 of the 105 prematurely born children (60%) had total scores at or above the 15th percentile. Fifteen of the remaining 42 had scores below the 15th but above the 5th centile (14.3%) and 27 (25.8%) had scores below the 5th percentile. While 13 of these 27 (12.4%) completed the test with abnormal scores (below the 5th) the other 14 (13.3%) refused to perform or to complete the test. The results of these children, according to the manual, had also to be considered below the 5th centile, but were kept separately.

Nineteen of the 63 children with total scores above the 15th percentile had a score below the 15th percentile on one of the sub-sections. Details of standard scores and centiles are provided in Tables 1 and 2.

3.1.1. Control group

When compared to the normative data, available from the manual, 99 of the 105 children (94.2%) had total scores at or above the 15th percentile. Six children (5.7%) had total scores below the 15th percentile, of which 1 (0.9%) fell below the 5th percentile. Twenty children had total scores above the 15th percentile but had a score at or below the 15th

Table 2

Movement ABC-2 standard scores in prematurely born children and in control group.

MABC-2 Standard Score	Prematurely born children		Control group	
	Median	SD	Median	SD
Total	7.11	3.74	10	3.14
Manual dexterity	7.24	3.42	10.99	2.97
Aiming and catching	7.58	3.52	9.57	3.11
Balance	8.17	4.4	9.97	3.35

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