PREMATURITY AS POSSIBLE INFLUENCE FACTOR ON THE POSTURAL CONTROL OF THE HEAD

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ABSTRACT

A stable postural control is the basis for the organization and voluntary execution of a movement. This is externalized through the development of motor abilities such as head control. Premature deliveries in themselves are pathological events which represent many risks to the child, thus, affecting the fast and integral development of their central nervous system, responsible for voluntary motricity. Comparing the development of head control among children born preterm and at term is the objective of this study. The study analyzed video recordings of 5 children born prematurely and 5 children born at term, at the age of two and four months respectively, who were participating in the Motor Development Follow-up Program For Children Born Preterm, maintained by the Londrina State University School Hospital / Department of Physical Therapy. Items related to the development of head control included in the Gross Motor Function Measure (GMFM) were used in the evaluation. There was a difference in the scores obtained by the preterm and at term children; however, these values were not significant according to the test t of Student. Results from this study suggest that premature birth does not represent a risk at the final development of head control. Despite

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the slightly late development in the acquisition of head control observed in the preterm children, both groups had similar scores at four months of age.

KEY WORDS: prematurity; head control; GMFM

INTRODUCTION

A stable postural control is basic for the organization and execution of voluntary movement as well as for social interaction and early communication. It serves also as an interface with the external world for perception and action (GROOT, 2000).

The bases to construct a future efficient motor performance are laid in the first two years of life. These bases include the ability to keep a steady posture, to perform voluntary movements and to maintain balance as well as the capacity to plan and execute the proposed act in a coordinated and controlled way (BURNS, 1999).

According to an internationally accepted definition, all children born before completing the 37th week of pregnancy are considered prematures. Premature delivery, by itself, is a pathologic event and the immediate exposition to the extra-uterine environment, with simultaneous loss of placentary coverage, puts the child in harm's way. In this condition, the development of the central nervous system (CNS) may be compromised (RUSSEL; CAMPBELL, 1975).

The motor pattern and muscular tonus of a premature child differ from that of non-premature baby and from a child in its first two months of life (RUSSEL; CAMPBELL, 1975).

At first, the control of the position of the head is intermittent and brusque while one take the upper limbs of the child when placed in a sitting position; soon, however, this condition is stabilized in the same period in which the social interactions and the interest on the environment awake in the newborn the desire to maintain the head up. (BURNS, 1999).

The steady control of the head in ventral position is usually followed by stabilization of the shoulder griddle during the support of the elbows and hands, which occur around the 4th month. The control on the position of the head is an important factor in the development of the suction and in the development of the ability to follow objects with sight (BURNS, 1999).

There are many evaluation instruments to analyze the motor and neurologic development, such as the Valoración Neurológica del

Recién Nacido y del Lactente (AMIEL-TISON; GRENIER, 1981), The Denver Developmental Screening (FRANKENBURG et. al, 1990), The Bayley Scales of Infant Development Second Edition (BAYLEY, 1993), Motor Assessment of the Developing Infant (PIPER; DARRAL, 1994), Chailey's Levels of Abilities (GREEN; MULCAHY; POUNTNEY, 1995) and Hammersmith Infant Neurological Examination (DUBOWITZ; DUBOWITZ; MERCURI, 1999). To support the present study it was used a modified GMFM – Gross Motor Function Measure (RUSSEL et. al, 1993) scale using only the items pertinent to the postural control of the head. This is a scale that allows the evaluation of the gross motor function and, particularly, the modification of this function along the time.

The present study is based on the analysis of prematurity as a determining factor in the postural control of the head, aiming to demonstrate that preterm children can present delays in the acquisition of certain abilities of the motor development.

MATERIALS AND METHODS

It is a retrospective study based on the analysis of 17 videotaped evaluations of preterm and fullterm children. Video shooting was done in the laboratory of Research on Children's Motor Development of the School of Physical Therapy at the Londrina State University (UEL) and analyzed by four observers that were trained by an accredited person in the use of this Protocol. Parents signed an informed consent that was approved by the local ethics committee.

The children were 2 to 4 months of gestational age corrected to the term (40 weeks).

Initially, 17 children were included in the evaluation of the neurological motor development. They were participating in another major project on Accompaining the Motor Development in preterm children and were randomly selected. However, 5 preterm and 2 term children were excluded since it was not possible to analyze some of the items from their footage.

Among the included children five were preterm and 5 were fullterm. In the preterm group (3 females and 2 males), born from 30 to 33 gestational weeks (average: 31 weeks and 2 days + 1 week and 2days), the weight at birth varied from 1,210 and 2,675 grams (average: 1646 + 585.21 g). The control group included 4 males and 1 female, born between 38 and 41 weeks of gestational age (average: 39 weeks and 4 days + 1 week and 2 days), weighing at

birth from 3,150 and 4,040 grams (average: 3498 g + 362.86 g). This information can be seen in TABLE 1 and TABLE 2.

The 88 items of the GMFM are analyzed by observing the child and scored in a 4-point scale (0= does not initiate; 1= initiate more than 10% of the activity; 2= complete the activity partially from 10% to 100%; 3= completes the activity). The items have the same weight and are grouped in five dimensions: 1 – to down lie and roll (17 items); 2 – to sit (20 items); 3 – to crawl and kneel (14 items); 4 – to stand (13 items) e 5 – to walk, run and jump (24 items).

Around 5 years of age children without motor development delay can usually accomplish all GMFP items (RUSSEL et. al, 2000). In this study it was used the items 1, 10, 11, 18, 21 and 22. In the table of collected data the items have their numbers modified to 1, 2, 3, 4, 5 and 6, respectively. Results were analyzed by the test t of Student. The items were as follows:

1 – Supine, head in the middle line; turn the head with simetrical extremities.

- Does not maintain the head in the middle line.
- Maintains the head in the middle line for 1 to 3 seconds.
- Maintains the head in the middle line, turns the head with asymmetrical extremities.
- Turns the head with symmetric extremities.

2 – Prone; lifts the head vertically.

- Does not initiate the movement of lifting the head.
- Begins to lift the head; chin in the mat.
- Lifts the head, does not attain vertical position; chin leaves the mat.
- Lifts the head vertically.

3 – Prone in the forearms; lifts the head vertically, elbows stretched, chest elevated.

- Does not begin lifting of the head.
- Begins to lift the head; chin in the mat.
- Lifts the head, does not attain vertical position; chin leaves the mat; effort in the forearm.
- Lifts the head vertically, effort in the forearm.

4 – Supine, hands are held by the examinator: pull towards seated position with head control.

- Does not initiate control of the head when pulled to sit.
- Initiates control of the head while pulled to sit.
- Pull to sit, control of the head is present part of the time.
- Pull to sit with control of the head.

5 – Seated on the mat with the chest supported by the examiner: lifts the head vertically and holds it up for 3 seconds.

- Does not initiate movement to lift the head.
- Initiates the movement to lift the head.
- Lifts the head, does not reach the vertical position, and holds it up for 3 seconds.
- Lifts the head, reaches the vertical position, and holds it up for 3 seconds.

6 – Seated on the mat, with chest supported by the examiner: lifts the head in to the middle line and holds it up for 10 seconds.

- Does not initiate movement to lift the head.
- Initiates the movement to lift the head but does not attain the middle line.
- Lifts the head to the middle line and holds it up for less then 10 seconds.
- Lifts the head to the middle line and holds it up for 10 seconds.

RESULTS

Preterm children are identified in TABLE 1. Three children had Apgar 9 at the 5th minute while the other two children had 4 and 7. It was also observed that the age of the mothers varied from 18 to 25 years.

TABLE 1 – Identification of preterm children.

PRETERM CHILDREN					
CASE	SEX	GESTATIONAL AGE (WEEKS)	WEIGHT AT BIRTH (G)	APGAR 5TH MINUTE	MOTHER'S AGE
1	M	30	1495	9	24
2	F	32	1410	9	20
3	F	30	1210	9	22
4	F	32	1440	4	18
5	M	33	2675	7	25

TABLE 2 shows the identification of fullterm children. The Apgar at 5th minute was 10 for 4 children and 9 for one, the maternal age varied from 21 to 39 years.

TABLE 2 – identification of the fullterm children.

CONTROL GROUP					
CASE	SEX	GESTATIONAL AGE (WEEKS)	WEIGHT AT BIRTH (G)	APGAR 5TH MINUTES	MOTHER'S AGE
1	M	39	3320	9	23
2	M	41	3690	10	39
3	F	41	4040	10	21
4	M	38	3290	10	35
5	F	39	3150	10	24

In TABLES 3 and 4 it can be seen the scores obtained by the preterm group and the fullterm group for each evaluated item at 2 and 4 months of age. In TABLE 3, in the item # 4 (2M) it was observed the lowest score among the analyzed items.

TABLE 3 – Scores for preterm children.

ITEM	1	1	2	2	3	3	4	4	5	5	6	6
CASE/ MONTH	(2M)	(4M)	(2M)	(4M)	(2M)	(4M)	(2M)	(4M)	(2M)	(4M)	(2M)	(4M)
1	1	3	0	3	0	2	0	0	1	3	1	2
2	2	3	1	1	2	3	0	2	1	3	1	3
3	2	3	1	1	1	1	0	1	0	3	0	2
4	0	2	0	3	2	3	0	2	1	3	1	2
5	0	3	1	3	1	3	0	1	1	3	1	3
MEAN	1	2.8	0.6	2.2	1.2	2.4	0	1.2	0.8	3	0.8	2.4
SD	1	0.45	0.55	1.09	0.84	0.89	0	0.83	0.45	0	0.45	0.55

TABLE 4 - Scores for fullterm children.

CASE	1	1	2	2	3	3	4	4	5	5	6	6
CASE/ MONTH	(2M)	(4M)	(2M)	(4M)	(2M)	(4M)	(2M)	(4M)	(2M)	(4M)	(2M)	(4M)
1	0	3	1	3	3	3	0	1	1	3	1	1
2	2	2	2	3	2	3	0	3	3	3	2	2
3	1	1	1	3	2	3	2	2	3	3	3	3
4	3	3	3	3	1	3	0	2	1	3	1	2
5	1	3	0	3	2	3	0	1	1	1	1	1
MEAN	1.4	2.4	1.4	3	2	3	0.4	1.8	1.8	2.6	1.6	1.8
SD	1.14	0.89	1.14	0	0.7	0	0.89	0.83	1.09	0.89	0.89	0.84

The data about the comparison between the two groups are presented in TABLE 5. There was no statistical difference, excepted for item 5 at 2 months of age.

TABLE 5 – Comparison between the scores of preterm and fullterm children (test *t* of Student).

	1 (2M)	1 (4M)	2 (2M)	2 (4M)	3 (2M)	3 (4M)	4 (2M)	4 (4M)	5 (2M)	5 (4M)	6 (2M)	6 (4M)
t-TEST	0.286	0.199	0.098	0.074	0.071	0.086	0.173	0.145	0.048*	0.173	0.056	0.108

*statistically significant

In FIGURE 1 it is observed that the preterm children at 2 months got a lower scoring than the fullterm children in all evaluated items.

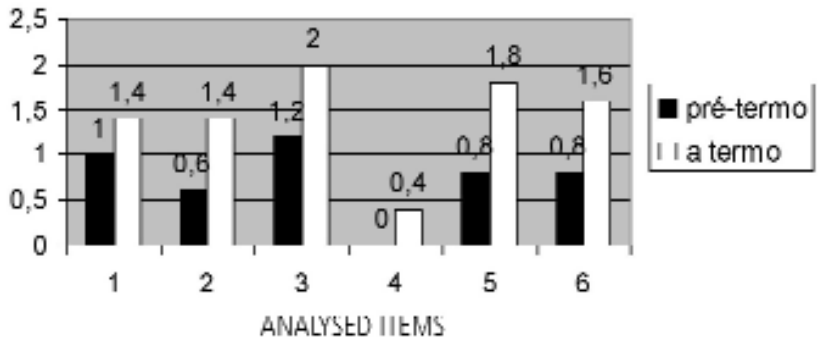

FIGURE 1 – Mean scoring and analyzed item of the GMFM.

In FIGURE 2 it is possible to observe the comparison between the mean scoring of preterm children and fullterm at 4 months. It can be seen that preterm ones outdid fullterm children in items 1, 5 and 6.

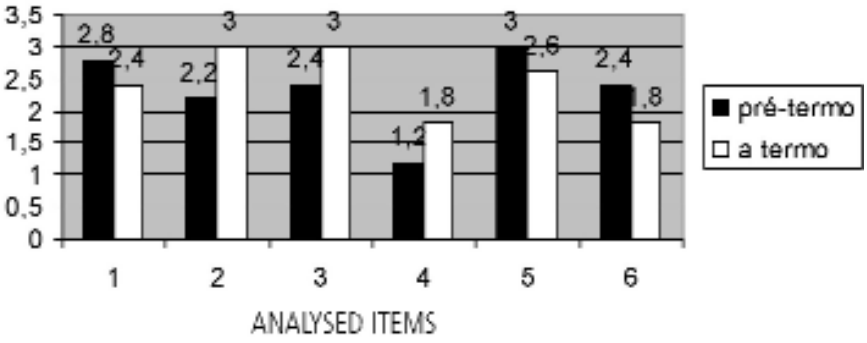

FIGURE 2 – Scoring of preterm and fullterm according to the analyzed items.

In FIGURES 3 and 4 one can see the comparison of the total scoring of preterm and fullterm children at 2 and 4 months, respectively. It was observed that the variation of the scoring of preterm children in this period was greater than that of fullterm children, since these already presented a greater scoring at 2 months.

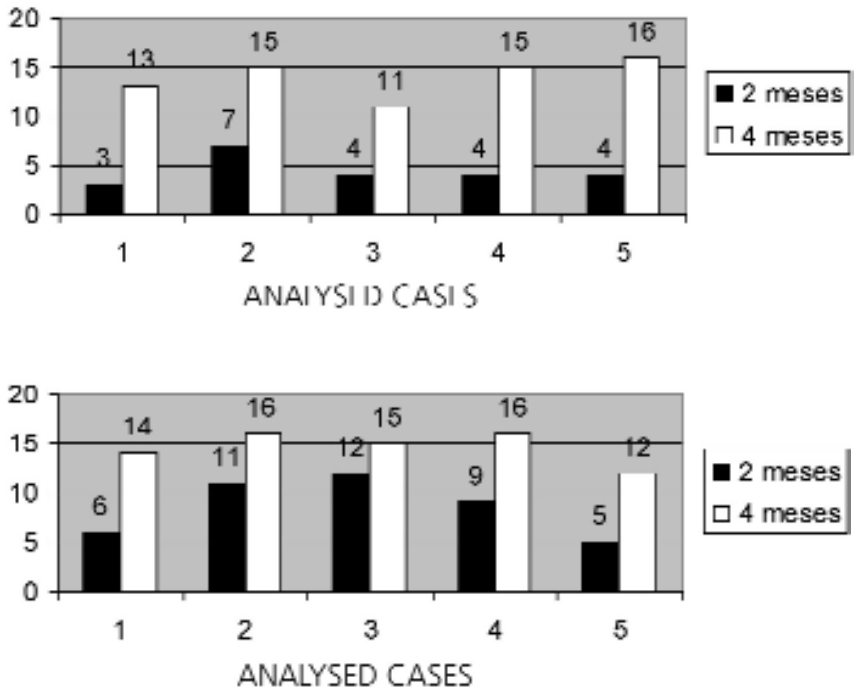

FIGURA 3 e 4 – Total scoring arond full term children at 2 and 4 rouths.

DISCUSSION

According to Gaetan (1999) some components of the movements to acquire motor abilities show a differentiated tendency in the development of preterm when compared to fullterm children. Piper and Darrah (1994) stated that the refinement that each child has to the process of neuromotor evolution assure that two children, even normal, will never be similar in their movements and evolution.

Besides that, MacGrew et al. (1985) considered that it may be difficult to state that existing differences in preterm children is an indication of delay, of great risk of deviation or if it represents a variation in the patterns of the neurological development.

Although showing a difference in the scoring between the groups, as showed, these scores were not statistically significant. In

TABLE 5 there was only one case of significant difference ($p<0.05$) in the 5th item (2M). In this item, four preterm children got score 1, when only trying to lift the head while one child did not even attempt to do it. However, in the fullterm group, two children presented already maximal scoring (3 points at 2 months) and three score 1. According to Gaetan (1999) the decreased axial muscular tonus in preterm children is of the aspects that make difference in the motor development of preterm as compared to fullterm children. These results can be attributed to the heterogeneity of the analyzed groups and to the small sample.

In item number 4 (2M) all children in the preterm group obtained zero scoring and can be seen in TABLE 3. In the fullterm group, only one child got score 2 (TABLE 4). This null scoring, however, may not represent abnormality in the development of these children; when in supine position with hand held by the examiner and pushed to sit, children do not have yet the necessary control to hold their head up, which is achieved only at 4 months. Besides that, each child presents its own pattern of development since their characteristics undergo constant influences from a group of transactions that occur between the child and their environment (AUSUBEL; SULLIVAN, 1970; SAMEROFF, 1980 apud BURNS, 1999).

According to FIGURE 1 in all analyzed GMFM items the mean punctuation of preterm children, at the corrected age of 2 years, was inferior to that for full term children. Knobloch and Pasamanick (1987) refer that fullterm children start their post-natal life with the advantage connected to a normal gestational period. They have slightly more mature behavior equipment and, therefore, are more prepared to the transition to an independent existence, which differentiate them from the preterm children.

A child's development can show some sudden halts in a given period and some time may elapse before it continues to progress. It is possible that the central nervous system is not enough developed or the child may be busy in developing other sort of abilities (HOLLE, 1979). This could explain the low scoring of fullterm children at 4 months in the items 1, 5 and 5 as can be seen in FIGURE 2.

According to Bly (1994) children with normal motor development have hyperextension of the head and neck balanced by the flexion in the third and four months and thus the child is able to lift and maintain the head in supine position and in the middle line. In case of abnomal development the flexion components of the head and neck are not developed and the child cannot achieve elevation

of the head to the middle line. These affirmations could not be confirmed in the present study in which the mean scoring of preterm children in item 1 (4m) was greater than for the item 1 (4m) in fullterm children (TABLES 3 and 4). In this connection, the control of the extensor and flexor muscles of the head of the preterm children at 4 months can be similar or even superior to that of the fullterm children. Therefore, the preterm children cannot be considered as having an abnormal motor development.

In the item 2 (4m) (TABLE 4) it was observed maximal scoring for fullterm children. Indeed, this was expected since in prone the children can support the head in the middle line, maintaining it continuously elevated in an angle of 90º at 16 weeks (KNOBLOCH; PASAMANICK, 1987). It can be seen also in item 3 (4m) (TABLE 4) a maximal scoring for fullterm children, which is adequate since, according to Knobloch and Pasamanick (1987), at 16 weeks children lift their body assisted by their elbows.

FIGURES 3 and 4 illustrate the progressive acquisition of motor abilities related to the support of the head between 2 and 4 months in preterm and fullterm children. It can be seen that the evolution of the preterm children was greater than the fullterm ones since the former have a scoring closer to what is possible to obtain at 2 months than the latter. Thus, the difference of scoring of the fullterm children at 2 and 4 months will be lesser. The preterm children showed that, despite the delay or difference in the acquisition of control of the head, after some months they recovered and reached the same status as the fullterm children for this given ability.

According to Burns (1999), in any age the child shows manifestations of development characteristic of the pertaining age but some variation can be seen from case to case according to certain hereditary attributes, with the influence of the experience of past events, the present situation, the special demands of the test and the constant transaction that take place between the child, people and the objects in their immediate environment. Case 5 (FIGURE 4) can be understood from this point of view. The child, despite a bad performance at 2 months, attained a good scoring at 4 months, matching the other children. However, in the items related to sitting position (items 5 and 6 at 4 months) this child kept a performing below the expected at 4 months. Maybe the environmental conditions or the situation of the moment were not adequate or these data just serve as an example of the individual variability in the acquisition of the motor abilities.

CONCLUSIONS

Taking into consideration the result of the present study it is possible to suggest that prematurity is not an influence factor in the final control of the head. Despite a slight delay in the development of the acquisition of the control of the head in the preterm children, at the end of the 4th month both groups showed similar scoring.

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