

CHANGES OF INFANTS' MOTOR DEVELOPMENT USING CORRECTIVE EDUCATION

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Abstract

The article deals with the research, the goal of which is stating the effect of corrective education on the impaired motor development of infants depending on the beginning of corrective education. In order to assess the motor development of infants the Munich functional development diagnostics was used. There participated 120 infants attending early rehabilitation service of Šiauliai consulting policlinics for children's disease clinics. The first assessment of the complex motions of infants was made in different age groups (group I – 3±0,5 months; group II – 6±0,5 months). Generalizing information in scientific literature about the results of evaluation of children's motor development in different periods until the age of one who had undergone neurodynamic therapy (NDT) and taking into consideration the results of our research we can say that the essential factor deciding the success of early intervention is infant's age at the beginning of corrective education. If complex correction begins earlier then it causes better results of psychomotor development.

Key words: *infants' motor development, corrective education, neurodynamic therapy (NDT).*

Child's psychomotor development concerns many steps of growth being a continuous process lasting from fecundation to full maturity of a child. Holistic attitude to the psychomotor development includes the unity of biological, social and psychological origin. Characterizing child's growth together with all psychomotor development various authors (Alexander at al., 2011; Bly, 2004; Trunovas & Kitajevs, 1997; Montesori, 2000) emphasize that stimulated by its need to move, a child increases metabolism with intensive movements of its body.

In many works (Mockevičienė, & Kardelis, 2005; Maceina, 1990; Šalkauskis, 1990; Bly, 2004; Andrikienė, & Ruzgienė, 2001; Laužikas, 1997; Trunovas, & Kitajevs, 1997; Montesori, 2000; Harris, 1993) both interaction of physical and psychic phenomena and three inseparable spheres of human development (physical, spiritual and psychic) are stressed. During the first year of life a very big role is attached to the motor system. Normal development of infant's other systems and psyche depend on its motor system. Many theories of individual's development consider motor skills to be very important. Laužikas (1997) says that a man depends on how he moves because not only psyche stimulates movement but movement has an effect on psyche as well.

It is evident that psychomotor development being an inseparable part of infants' movements, senses and thinking, during the first year of its life is an important phenomenon acknowledged by many professionals (Helbruge, & Vimpfenas, 1995).

The important thing is that it is possible to evaluate this phenomenon objectively. With the help of diagnostics of the development of complex movements we can estimate psychomotor development in infancy. In later periods the above mentioned psychomotor spheres split into separate spheres of individual's development nevertheless there remain certain inner links among them regulated by factors of socialization (Radzevičienė, 2005). Normal motor development corresponding to the child's age especially in the first year of life is one of the most important indicators of child's health which depends on living conditions, regime of work and rest, economics, education, psychological factors and active movement.

Actuality of the theme enabled to formulate a problem question: can purposeful and systematic corrective education influence the development of impaired movements more if it begins in the early period of infancy rather than later?

Having formulated the problem, **the object of research** has been determined – the development of impaired movements of infants. Scientific solution of the research object corresponding to the subject of cognitive activity is directed to the changes of the development of infants' impaired movements using corrective education trying to find the causative link between those variables.

We have chosen general development of movements (crawling, sitting, walking and snatching) as dependent variables of the analysis of the research object. The independent variables in this research are infants' age, influential means used in the programme of corrective education.

Having chosen those variables we had **a goal** of stating the impact of corrective education on the changes of infants' impaired movements depending on the beginning of corrective education. Seeking our goal we have determined the following **tasks** in our work:

1. To state the dependence of the beginning of corrective education and clinical diagnosis of psychomotor impairments.
2. To apply the programme of corrective education for infants with impaired movements referring to NDT/ Bobath (neurodynamic therapy), pedagogics of early education and principles of psychology and family pedagogics.
3. To estimate the effect of the programme of corrective education on general motor development of the investigated infants.

Research methodology

Theoretical methods. Analytical and generalizing methods for the analysis of the literary sources associated with the research subject were used, the results of the investigation were discussed and compared with the data of similar investigations made by other authors.

Empirical methods. The Munich diagnosis test of functional development (MFRD) was used for evaluation of motor development of infants. In order to find out the peculiarities of changes of movements standard MFRD methodology was used. Preparing the Munich diagnosis test we took into consideration the long-lasting observations of infants' and small children's behaviour made by Munich Centre for Children (Gedminaitė, 1998). Munich diagnosis of functional development is a complex investigation measuring the level of development of different functions. Estimating their level the age of development (in months) is indicated comparing these values with the infant's chronological age (Hellbruegge, 1985). This methodology corresponds to the main criteria of objectivity, validity and reliability. Objectivity is assured by concrete tasks and criteria of their estimation. Infants having this skill at a certain age are considered as normally developing. We have chosen the following values from MFRD for estimation of infants' general motor development:

1. Crawling age (indicates the development of crawling);
2. Sitting age (indicates the development of sitting);

3. Walking age (indicates the development of standing and walking skills);
4. Snatching age (indicates motor development of the palm).

The scheme of complex motor development received while applying this methodology indicated the level of the motor age when corrective education should be started. The goals of the programme of corrective education depended not on the chronological age of infants but on the age of their complex motor development.

The choice of methodology was stimulated by its accessibility both to the professionals and to the members of infants' family. Active participation of parents in the investigation helped to create better contacts between a professional and parents, trustworthy atmosphere that is very important for the professional's work with the family and with the infant. Another reason for choosing MFRD test was that the programme of corrective education used in the experiment was based on the same principles of infants' normal neurodynamic motor development.

Educational experiment was performed according to the programme of corrective education, individually made for the infant according to the age of complex motor development.

Methods of mathematic statistics were used for the analysis of research data. Research data were processed by computer programmes Exel and SPSS. The statistical methods (descriptive statistics, Kaiser coefficient) were used analyzing the results of quantitative research findings. The results obtained have been processed and analyzed based on the reliability index ($p \leq 0,05$). Indicator of statistical significance (p) shows that the results are statistically significant.

Organizing research and its contingent

The experiment was made with the infants who attended the early rehabilitation service (ART) of Šiauliai consulting polyclinics for children's disease clinics. Dividing infants into groups and making further assessments of complex movements, we used the periods of infancy suggested by Badaljan, & Žurba (1988). Before the experiment the first assessment of infants' complex movements using the Munich functional development diagnostics test was made in the groups of different periods of infancy: in the first group of the period of early infancy ($3 \pm 0,5$ months, $n = 65$); in the second group of the period of late infancy ($6 \pm 0,5$ months, $n = 55$).

Individual corrective education of infants with impaired movements took place once a week with active participation of parents. Parents were taught to apply corrective education in everyday activity. There were no more sessions of corrective education for infants whose complex motor development reached the norms of their age. Every three months the development of complex movements of all the researched infants was assessed until they became one year old.

Estimation of the research results

Trying to find out what motor disorders persuaded doctors to send infants to the early rehabilitation service we analysed those reasons and divided the infants into three groups according to the indications of muscle tonicity disorders or motor disorders characteristic only to a certain age of infants or if both factors were characteristic at the same time.

Muscle tonicity is only an indicator defining motor function and the basis of further motor development (vertical posture, balance, resisting gravitation and determined movements). Tonicity is controlled by the sphere of reflectory spinal cord segmental apparatus and sub-cortex regulation and higher centres of brains into psychomotor development are included. When motor functions improve, the reflex system of movements acquires the character of conscious control of active movement. We think that infants with such impairments had been sent to early rehabilitation in order to control and regulate further motor development.

Analysis of medical documents showed (Fig. 1) that distribution of muscle tonicity and non-specific motor disorders differed in the I and II groups of the researched infants. In the group of early infancy period (group I) 62% of the researched had diagnosis of muscle tonicity disorder and in the group of later infancy period (group II) there was no such case. In this group 76% of the researched had impairments of two sorts – muscle tonicity and non-specific motor development. It could mean that disorders of motor development were not always noticed in the first months of infancy.

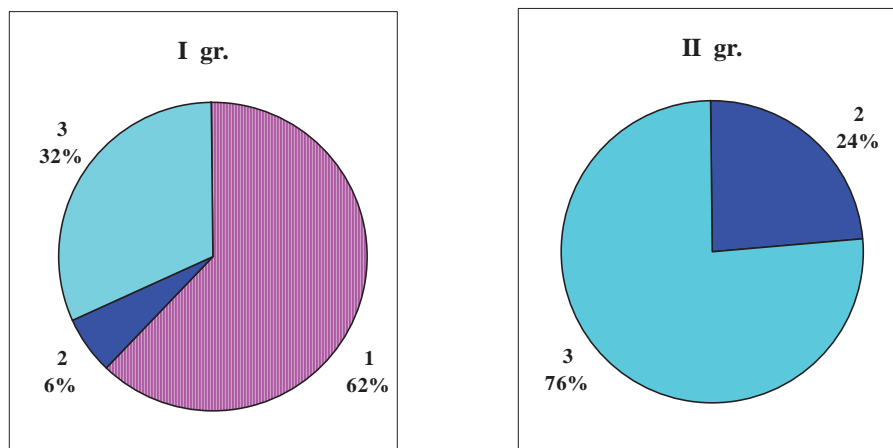


Figure 1. Distribution of the I and II groups of the researched infants according to their impairments diagnosed by doctors (%)

1 – disorders of muscle tonicity; 2 – non-specific disorders of motor development;
3 – disorders of muscle tonicity and non-specific motor development.

On the basis of these presumptions and the research results received before the experiment we emphasized positive factors of physical and emotional environment in our programme of corrective education and also used adequate specific corrective means causing decrease of infants' muscle tonicity (or at least its stability) during the sessions of corrective education. In order to be certain about the given presumptions concerning the proper choice of methods in the early period of infancy (group I) and diagnosing infants' muscle tonicity, other more exhaustive investigations should be made because it is fairly important for appointing early corrective education to infants.

Having made the first investigation with the help of MFRD test the results (Table 1) show that in groups I and II the development of all four complex movements falls behind the norm quite significantly ($p < 0,001$). Nevertheless in group I reciprocal differences of complex movements were indistinct ($p < 0,05$) while in group II those differences were more distinct. In group II (6 months) the age of infants' crawling function development reached only 3,8 months ($p < 0,001$) and developed slower than other functions of complex motions (sitting - 4,4 months, walking - 4,1 months, snatching - 4,7 months ($p < 0,05$)). Evaluation of complex motor functions before the experiment showed that in group I the crawling function was also behind the norm. In both groups the snatching function was best developed (group I – 2,0 months; group II – 4,7 months). All the four complex motor functions indicate the age of general motor development (crawling, sitting, walking, snatching). Before the experiment the researched infants' average age of general motor development reached only $1,8 \pm 0,66$ months in group I and $4,2 \pm 1,38$ months in group II. It shows that motor development of the researched infants lagged behind other infants of the same age (group I – $3 \pm 0,5$ months; group II – $6 \pm 0,5$ months).

Table 1

General motor development (GMD) before experiment (month) in groups I and II

	GMD (month)	Standard digression	Standard error
Gr. I	1,8	0,66	0,08
Gr. II	4,2	1,38	0,19

The research results show that in both groups there were infants whose general motor skills (Fig. 2) corresponded to chronological age (group I – 18% and group II – 22%). In group II general motor development of the majority (29 %) was 2 months late that corresponded to the chronological age of 4 months. In group I general motor development of most of the infants (48%) was 1 month late and corresponded to developmental norms of 2 months. Even 31% of infants in group II were late with their general motor development for 3-5 months and in group I the development of 4% of infants corresponded to the norms of the newborn babies.

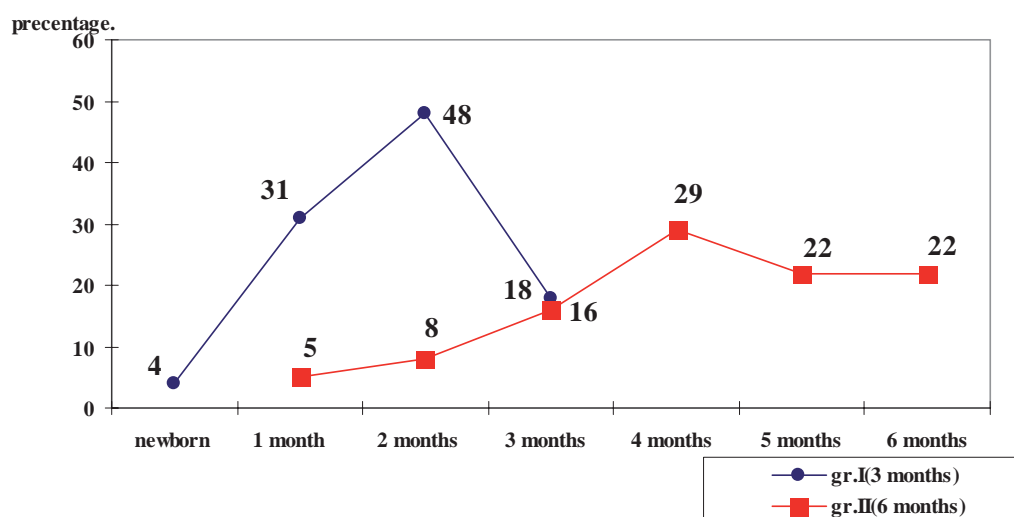


Figure 2. Distribution of infants (%) in groups I and II according to the age of general motor skills before the experiment

Analysis of the research data showed that in groups I and II the development of various motor functions differed. Because of this it is not possible to state that crawling, sitting, walking and snatching functions characterize general motor development of infants hence there correlation analysis of motor functions was made.

It revealed that the link between the motor functions was strong and profound (Table 2). KMO (Kaiser) coefficient (0,85 %) shows that correlation matrix is suitable for factual analysis as one factor covers 84% of general dispersion. Having such high correlation coefficients (Table 3) it is possible to state that functional spheres (crawling, sitting, walking and snatching) are interrelated. On this ground we have calculated general motor level and dynamics.

We have discovered that corrective education influenced general motor development in different ways. The picture shows the impact of corrective education in the early period of infancy (group I) during the first three months. The age of complex motor functions of 69% of infants in group I reached chronological age and only less than one third of infants had to continue exercises of corrective education till the end of infancy (31–23%). When these

exercises started later (after the 6th month), during the first three months motor functions only of 22% of infants reached the norms of chronological age and the rest had corrective education till the end of infancy.

Table 2

Correlation links of motor functions

Motor functions	Crawling	Sitting	Walking	Snatching
Crawling	1,0			
Sitting	0,88*	1,0		
Walking	0,79*	0,80*	1,0	
Snatching	0,75*	0,76*	0,74 *	1,0

* p < 0,001

Table 3

Parametres of the scale of general motor development
(Extraction Method: Principal Component Analysis)

Motor functions	Factor weight (L)	Correlation with the scale	Descriptive power of factors
Crawling	0,94	0,88	
Sitting	0,94	0,89	84%
Walking	0,91	0,84	
Snatching	0,89	0,80	
Reliability	Parametres: Cronboch $\alpha=0,93$; Guttman's split-half Average intercorrelation 0,79	coefficient 0,92	

Having estimated general motor development (Table 4) we have noticed that in group I motor skills of children were developing evenly and already in the 9th month they corresponded to the developmental norms. In group II corrective education started only in the 6th month so general motor development improved but not so fast (9 months corresponded to 7,1 months development norm and 12 months – to 10,1 months development norm). One could notice a tendency proved by t-criterion that when children were growing, in every age period the differences between the groups were diminishing. It shows that in group II the difference between the general motor development and its norm was distinct but it was decreasing when the children were growing.

Our results demonstrated that when corrective education started later it determined slower and not full liberation of motions. Analysis of the results revealed that the impact of corrective education on the infants from group I was most effective in the first stage of the experiment during the first three months. We should analyse the question why delayed corrective education determines much slower and not full regaining of motions: were there any gaps in the programme of corrective education or was it because of the older age when corrective education started? As we haven't managed to find any investigations of this kind, our discussion will be based on the results of our researches and physiological mechanisms

of psychomotor regulation. We think that starting corrective education earlier (at 3 months) caused better results because at this age motor expansion should have reached the first stage of psychomotor development when movements develop on the grounds of reflexes. In the programme attention is being paid not only to reflexes and reflective reactions while educating infants of this age but early pedagogics and psychology are also taken into consideration in order to stimulate emotional background (Andrikiene, & Ruzgienė, 2001). Perhaps it had a positive effect on the improvement of psychomotor mechanism already in the first stage of development of motor skills, that's why such a good effect was achieved during the first three months of corrective education (in group I motor functions of 69% of infants reached the developmental norm). However starting education at the age of 6 months (group II) when the formation of intermediate complex motions begins for normally developing infants, it is more difficult or even impossible to stimulate normal mechanisms of physiological regulation without the initial stage of development. Our research showed that in this group movements of infants were getting liberated extremely slowly. There arises a question about the relevant choice of our programme which could influence slower development of functions. But the results of motor functions when corrective education in group I has begun at the age of 3 months, prove that 81% of infants at the age of 9 months needed no further corrective education. The research results correspond to the idea of Helbrügge and Vimpfen (1995) that in the early stages of development the ability to adapt and to change that adaptation is really big but later it is gradually diminishing. On the other hand the child of the earlier developmental stage is more able to regenerate what had been impaired because his growth is more vigorous and it is easier for him to adapt.

Table 4

Change of general motor development (GMD) in groups I and II

Age	groups	GMD (month)	Standard digression	Standard error	Levene's test	t-tst
6 months	I gr.	5,8	0,9	0,11	F = 9,5	t = 7,9
	II gr.	4,2	1,3	0,17	p = 0,003	p < 0,001
9 months	I gr.	9,1	1,1	0,13	F = 25	t = 7,3
	II gr.	7,1	1,9	0,25	p = 0,001	p < 0,001
12 months	I gr.	11,9	1,2	0,15	F = 36	t = 5,1
	II gr.	10,1	2,4	0,33	p = 0,001	p < 0,001

Deviation from the norm of child's development during the first months of his life doesn't mean that he will have a long-lasting and permanent motor impairment. Our experiment showed that early correction was very important for the development of infants' motor skills. Examining many researches on the effectiveness of corrective education, Haris (1993) says that after the first and the second year of life it is high time to give up the idea of making muscle tonicity, positions of reflexes and movements normal but it is necessary to seek functional goals which could be used by a child in everyday activity.

Generalizing information in scientific literature about the results of evaluation of children's motor development in different periods who had undergone neurodynamic therapy (NDT) and taking into consideration the research data of this article it becomes evident that the essential factor for the success of early intervention is the infant's age when corrective education begins. If complex correction begins earlier then it causes better results of psychomotor development.

Conclusions and discussion

The article deals with the research, the goal of which is stating the effect of corrective education on the impaired motor development of infants depending on the beginning of corrective education. In order to assess the motor development of infants the Munich functional development diagnostics was used. There participated 120 infants attending early rehabilitation service of Šiauliai consulting polyclinics for children's disease clinics. The first assessment of the complex motions of infants was made in different age groups (group I – $3\pm 0,5$ months; group II – $6\pm 0,5$ months).

The research results showed that in the first group impaired muscle tonicity was diagnosed for majority of infants and in the second group – impairments of natural motor development and muscle tonicity. We have found out that in both groups motor development of infants before the experiment was much behind the chronological age. In both groups of infants, regaining of their impaired movements was very rapid during the first three months of corrective education. Generalizing information in scientific literature about the results of evaluation of children's motor development in different periods until the age of one who had undergone neurodynamic therapy (NDT) and taking into consideration the results of our research we can say that the essential factor deciding the success of early intervention is infant's age at the beginning of corrective education. If complex correction begins earlier then it causes better results of psychomotor development.

The research showed the principles of the changes of infant's motor development using corrective education:

1. In the period of early infancy (until 3 months) increased muscle tonicity is usually found and later (3-6 months) combined impairments (muscle tonicity and natural motor development) are mostly diagnosed.

2. In both groups the age of the investigated complex motor function of infants before the experiment was a great deal behind the chronological age norm (group I – 1,8 month; group II – 4,2 months).

3. Using corrective education in the early (3 months) period of infancy all the impaired complex motor functions of the majority of infants (77%) reached the norms of chronological age development at the end of infancy (12 months). The effect of corrective education which started later (6 months) was much smaller, the development of motor functions was late (1–2 months) and only 39% of infants had reached the norm of chronological age development by the end of infancy.

4. In both groups regaining impaired complex motions was the fastest during the first three months of corrective education.

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