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Original Article

## A CASE STUDY REGARDING THE EFFICIENCY OF INTERVENTION THROUGH KINESIOTHERAPY IN PREMATURE INFANTS

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### Abstract

*Purpose.* The recorded experiment based on a case study was performed at Bacău Maternity County Hospital, on the second floor in the last two weeks until his being discharged, in the "Sensorial Room" at the Kinesiotherapy Base of "Vasile Alecsandri" University of Bacău and at the patient's house for six and a half months. This paper is a case study performed on a 6-week premature infant, over a 7-month period of time.

*As research methods.* We used the bibliographic method, observation, testing, data interpretation method and graphical method. As applicative intervention, we used kinesiotherapeutical programs in order to improve the infant's functionality and facilitating the acquisition of motricity specific to the chronological age.

*Results.* The results were recorded both according to the ontogenetic development and to the maturity of the reflex, orofacial and respiratory function, which underline the efficiency of the kinesiotherapeutical intervention.

*Conclusion.* Due to the fact that the assessment and exploration methods were objective, the results gathered are concrete, demonstrating the efficiency and importance of kinesiotherapy in a premature newborn.

*Key words:* kinesiotherapy; premature; newborn.

### Introduction

A newborn weighing 1.520 kg, delivered before 37 weeks is considered a premature baby. According to the pregnancy age at birth, premature newborn babies can have a weight corresponding to the pregnancy age, lower or higher than the normal one. A normal threshold for weight is considered 2.500 kg. For premature and overweight children there is a risk for inadaptation to the extrauterine life, for which they need qualified help to adapt to the new mode of existence. "A premature infant needs special care because its vital organs are not ready for life.

It needs an incubator in order to maintain its heat, it needs mechanical ventilation in order to be able to breathe, and above all, medical treatment should not be missing" (Adrian Crăciun, head of the Neonatology Department, Cantacuzino Maternity Hospital, <http://www.romanalibera.ro/stil-de-viata/sanatate/cum-prevenim-nasterile-premature>, 30.03.2013, at 13.05).

The child's development is "a qualitative process of cellular differentiation which is expressed by functional modifications" (Cordun, M., 2009, p. 50). Reaching development to ensure movement independence is a parent's main objective in his/her child's development. However, there are still some development and manifestation differences between children even from their birth, differences which can negatively influence the infant's further evolution. Kinesiotherapy, as practical form of intervention, "provides the recovery of the deficient functions and the acquisition of functional independence, by placing the subject to exercise an active role in its own shaping

and development" (Teodorescu, S., Bota, A., Stănescu, M., 2007, p. 2).

A term baby born with a low birth weight in relation to gestational age (delay of intrauterine growth) presents changes in growth or neurological manifestations different from a newborn whose weight and development correspond to the gestational age. That is why an estimate of the gestational age is essential for interpreting the observations made during the neurological examinations, but also for establishing the child's evolution procedure. A lack of a profilactic and kinesiotherapeutical intervention, as well as delays in following the developmental stages up to 6-7 months, facilitate the occurrence of psycho-motor deficiencies and sechelaes.

"The evolution of specific disorders depends on the patient's age" (Marcu V, Dan M., 2010, p.139), but the interventions as closely as possible to the date of birth of a premature infant require good knowledge of the characteristics of development, but also a great responsibility. The stimulation of the functional development as a way to improve the neurological manifestation determines "neuronal adaptation which is very important in the initial stage of a profilactic recovery program" (Sbenghe, T., 1999, p. 387).

A kinesiotherapeutical intervention determines improvements in functionality, but in a scientific presentation "the greater the strength developed is, the greater the intensity of the effort increases, and the higher the capacity is, the lower the intensity of the effort decreases within the programmed limits and therefore it can be longer maintained" (Cordun, M., 2011, p. 164).

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An intervention as fast as possible, having well-structured objectives, can reduce the level of deficiencies present in a premature birth and can stimulate the infant's normal functional development. "When establishing the treatment's objectives, we should always start from an assessment as objective as possible, regardless of the manner of intervention and field of activity" (Rață M, 2011, p. 49), and these shall be distributed in time according to the possibility of achievement and importance at the corresponding moment. Approaching this topic is motivated, on the one hand, by the fact that the related topics are very restricted and on the other hand, by the necessity to underline the importance and efficiency of a kinesiotherapeutical intervention as closely as possible to the date of birth.

A fast and accurate assessment of a premature infant allows good knowledge of the level of the developmental stage, which allows establishing the objectives and elaborating the intervention program through kinesiotherapy as objectively as possible.

### Research Hypotheses

In this research we started from the following hypotheses:

1. if we perform an early kinesiotherapeutical intervention in a premature infant we can recover the motor delay (the chronological age coincides with the biological age);
2. if we perform an early kinesiotherapeutical intervention in a premature infant we can avoid the risks of installing psycho-motor sechelaes.

### Material And Method

Our research was performed for 7 months (September 2012- March 2013), period which included the theoretical research and the subject's therapeutical activity. The patient born prematurely (at 31 weeks and 1.400 kg) was intubated and administered surfactant, and then sent to intensive therapy where he was given oxygen for 24 hours. At the moment of birth, he suffered from a hypoxia and a reduced haemorrhage. Having this patient registered in medical records, 6 weeks after his birth and knowing all the signalled aspects, we designed a kinesiotherapy program into two stages. The program had as objective the recovery of the motor delay in the first stage and the observation and therapy continuation in the second stage. The purpose of the kinesiotherapeutical intervention is to eliminate and decrease the risk of a pathological record with negative effects in time. The frequency of appointments was three times a week, and his parents continued the recommended therapy for the rest of time. The recorded experiment based on a case study was performed at Bacău Maternity County Hospital, on the second floor in the last two weeks until his being

discharged, in the "Sensorial Room" at the Kinesiotherapy Base of "Vasile Alecsandri" University of Bacău and at the patient's house for six and a half months.

As research methods, we used the following: theoretical documentation, observation, case study, testing, data analysis and interpretation.

*Assessment and estimation* were performed by using Dubowitz Method (1970). This method highlights both the external and the neurological features and calculates the gestational age of the premature infant, by estimating 21 well-defined physical and neurological signs.

The minimum score can be 0, and the maximum score 72 (35 neurological signs; 37 external signs). Formula: estimated age =  $(0.2642 * (\text{total score})) + 24.595$ . The estimation method of the gestational age of the fetus was based on the 21 well-defined physical and neurological signs. This method enables the estimation of the gestation age  $\pm 2$  weeks, in 95% of infants.

The neurological signs which were estimated in the initial and final testing were represented by: posture, hand flexion on the forearm, leg dorsiflexion, arm retraction, leg retraction, popliteal angle, heel to ear, scarf sign, head suspension, ventral suspension and out of the external features, the following were estimated: tegument texture, edema, skin colour, skin opacity, lanugo, plantar ridge, nipple formation, breast size, ear consistency, feminine genital organs (with hips in semiabduction).

The second assessment method was performed by using Kuban KCK Method (1986), which estimated the tendon reflexes (mandibular, large pectoral, biceps, brachioradial, triceps, finger flexor, patellar, hip adductors and crossed adductors, achilian muscles). To these, we added the assessment of ontogenesis according to Vojta, which helped establishing the developmental age.

### Therapeutical Intervention

*Kinesiotherapeutical intervention*, as a manner of stimulating functionality, is not easily accepted by an infant, regardless of the manner in which it is performed, because it constitutes, at first, a stressful external factor. A stimulus introduced by a kinesiotherapist in an infant's treatment leads to a reaction. The infant's reaction is of low intensity at the beginning of the intervention, but it increases over the next appointments. In very small infants, the intervention is performed so that the infant could send the expected response.

It cannot be sent, as in adults, by minute descriptions, by formulating requests or by indications, but by stimulating and encouraging behaviour means. It was conceived to fulfill the following objectives: performing/ promoting normal forms of movement in order to prevent from installing the pathological ones and to fight postures which lead to pathological ones;

stimulating /facilitating the respiratory function to prevent respiratory disorders; decreasing/ shortening the period of artificial feeding and educating coordination of breast suction, swallowing and breathing; improving/increasing and balancing muscle tone in order to reach developmental stage according to the chronological age; balancing sleep-wake cycle mechanism; stimulating/facilitating and strengthening parent-child interaction.

The recovery program was performed in two distinct stages, under different conditions and with different objectives. In the first stage, our work with the infant took place in hospital carefully monitoring heart beating, oxygen intake, heart rate, respiratory rate and facies colour. A very slow general massage was performed, and also Vojta stimulation from the 1st stage of rolling over for only 5 seconds, slow passive mobilizations and stimulations of the primitive reflexes.

In the second stage, we added the oro-facial stimulation, passive-active and tactile general motor stimulation, manual chest compression and postures. These manners of stimulations were performed for 10-15 minutes and they had an effect especially on the spontaneous motricity, oro-facial function and breathing. The oro-facial stimulation was used to bring to normal the muscle tone and also to educate *sucking* and *swallowing*. The vestibular, proprioceptive motor, tactile, visual and auditory sensory stimulation was intended for *tone regulation* and *neurosensory stimulation*. In order to improve the respiratory function, we used soft manoeuvres of manual chest compression. These were performed during exhaling and inhaling movements. We alternated free exhalation and inhalation with a soft compression at the end of inhalation.

We also performed a soft abdominal pressure to stimulate the diaphragm's activity. In order to strengthen muscle tone we used postures. During these procedures, muscles need to fight gravitational force which imposes an expanded position, an opposite position to the physiological one, by placing the body in certain positions. These were used to promote flexion and extension of the segments, but also to orient towards the medial line of limbs and postural symmetry. These activities during the intervention were performed in the presence of a family member. By using *massage*, we noticed an exercise of different sensory stimuli.

At the first contact, we seized an increase of the heartbeat, but it got back to the initial value once he got accustomed to it and relaxation occurred. A soft smoothing and friction massage was performed for tactile stimulations and also pressures on the

articulations for proprioceptive stimulation. First, passive *immobilizations* of the body segments were performed and together with the increase of muscle tone, we worked on the limb movements under the gravitational force, facilitating posture reactions.

This *intervention plan* included also a part of the program which was continued by parents at home. They performed visual and auditory stimulation with a toy, sensory stimulation by massage and vestibular and proprioceptive stimulation with a gymball. After the child reached the necessary acquisition equivalent to 2 months of age, the work against gravitation was more challenging, therefore exercises focused on the stimulation of an antigravitational motricity and met the ontogenetic requirements.

The duration of the kinesiotherapeutical intervention under direct supervision of the kinesiotherapist was 6.5 months, but the infant was monitored until he turned one year of age and started to walk independently.

## Results Of The Research

All the observations taken from the initial and final assessment were recorded and are found in the observation sheets, and in this paper, they can be found summarized in table no.1 and no. 2 and are represented in graphic no. 1. Data interpretation included the results both of the initial and final assessment.

The scoring by Dubowitz Method which followed the progress during hospitalization for neurological signs (tab. no. 1) was 13 points at the initial testing and 24 points at the final testing, therefore an increase by 11 points. The neurological signs were estimated in the initial testing with values between 0 and 2 points, and in the final testing between 2 and 3 points. The highest progress by 2 points was recorded at hand flexion on the forearm, leg retraction and head suspension, and the lowest by 1 point was recorded at the others (posture, leg dorsiflexion, arm retraction, popliteal angle, heel to ear, scarf sign, ventral suspension).

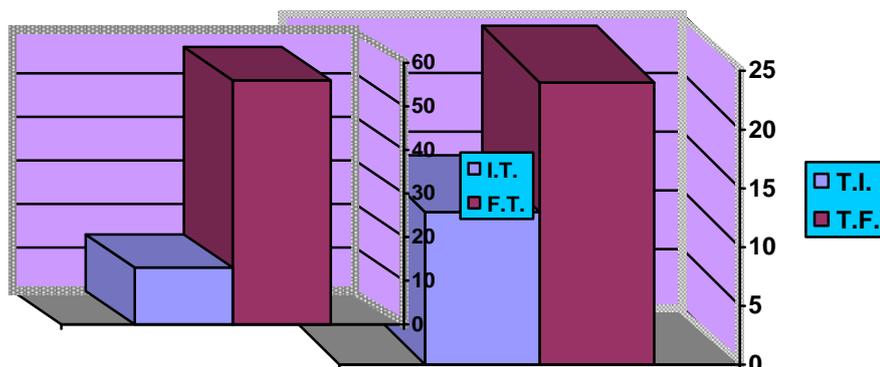
For external features (tab. no. 1) the initial score was 25 points and the final score was 51 points, so we recorded an improvement of 26 points. The external features were estimated at the initial testing with points between 0 and 2, and at the final testing between 2 and 4. Progress by 3 points was recorded for tegument texture, edema, skin colour and plantar ridges, by 2 points at skin opacity, nipple formation, ear consistency and feminine genital organs (with hips in semiabduction), and by 1 point at lanugo, breast size and ear shape.

Table. No.1 Dubowitz Scoring for external and neurological criteria

<i>Neurological signs</i>	I. T.	F. T.	<i>External features</i>	I. T.	F. T.
Posture	2	3	Tegument texture	1	4
Hand flexion on the forearm	0	2	Edema	1	4
Leg dorsiflexion	1	2	Skin colour	0	3
Arm retraction	1	2	Skin opacity	1	3
Leg retraction	1	3	Lanugo	2	3
Popliteal angle	1	2	Plantar ridges	0	3
Heel to ear	2	3	Nipple formation	0	2
Scarf sign	2	3	Breast size	2	3
Head suspension	1	3	Ear shape	2	3
Ventral suspension	2	3	Ear consistency	1	3
			Feminine genital organs (with hips in semiabduction)	1	3
Total points	13	24		25	58

After calculating the points accumulated during assessment by using the formula for estimating the gestational age, we found the following estimation =  $(0.2642 * (\text{total score})) + 24.595$ . Therefore, in the initial assessment, his age was 31 weeks, after the final testing, his age was 40 weeks. We can say that this

newborn was discharged from the hospital with a developmental age of 40 weeks and a chronological age of 2 months, which means a difference of 8 weeks between the chronological age and the developmental age.



Graphic no. 1 Testing Dubowitz scoring

Graphic no. 2 Testing tendon reflexes

\*Legend: I. T.-Initial testing, F. T. –Final testing of Dubowitz scoring

Assessment by Kuban KCK Method (1986) (table no. 2) underlines the fact that tendon reflexes were present at the initial testing (hospital discharge), at only 3 levels out of 9, with a normal intensity in the

large pectoral muscle and with a low intensity in the mandibular and finger flexor.

At the final testing (7 months) the reflexes of 8 levels were present with a normal intensity in the mandibular, large pectoral, biceps, triceps, finger

flexor, patellar, hip adductors and crossed adductors, achilian muscles.

Table.no.2 Results of Kuban K.C.K. Method 1986

<i>Tendon reflexes</i>	<i>I.T.</i>	<i>F.T.</i>
Mandibular	Present (but with low intensity)	Present
Large pectoral	Present	Present
Biceps	-	Present
Brachioradial	-	Present
Triceps	-	Present
Finger flexor	Present (but with low intensity)	Present
Patellar	-	Present
Hip adductors' and crossed adductors' muscles	-	Present
Achilian	-	Present

## Discussions

According to Broderick, E., (2011) "premature new-borns receiving massage therapy have a more rapid growth in weight than the ones who do not", which is an aspect underlined and highlighted in our study, demonstrating that there is a possibility that after the kinesiotherapeutical intervention the delays are recovered. The normal manifestation, after 6.5 months of tendon reflexes, as well as the improvement of the neurological aspects and external characteristics underlines the efficiency of the kinesiotherapeutical intervention at an early age, as closer as possible to the date of birth. The local effects recorded which led, first of all, to a general balance of the organism, and secondly, to the improvement of the child's health state, without a helplessness state, prove that "the neuromotor development is the result of the combined influence of the genetic and environmental factors, which complete the most efficient movement patterns. An "early stimulation of the child, meant to reduce the possible handicap, together with the parents' training for positioning and mobilization of the new-born" (Robănescu, L., Bojan, C., Coltoş, M., Cosac, E., 2006) is important in the child's future evolution. We can also mention the fact that the 8-week difference between the developmental and chronological age was recovered over the 6.5 months of kinesiotherapy. The child was monitored for a year in order to seize the verticality process until acquiring walking. In addition, "introducing music therapy together with kinesiotherapy for the motor and psychological rehabilitation of patients makes the process more efficient and favours a faster recovery (Ogłodek, E., Araszkiwicz, A., 2010, s. p. 171-172), an aspect taken into consideration and which must be taken into account in the future.

## Conclusions

Following this research and the results gathered, we can say that the hypotheses initially established were confirmed, the kinesiotherapeutical program which was thoroughly designed and introduced at an early stage had an indubitable role in improving the deficiencies of the premature infant.

The normal manifestation of the tendon reflexes, as well as the improvement of the neurological aspects and external features underline the efficiency of the kinesiotherapeutical intervention at an early age.

The analysis of the patient's evolution, following the kinesiotherapeutical program emphasized the recording of local effects which led firstly, to a general balance of the organism and secondly, to an improvement of the infant's health condition, without the installation of helplessness condition.

We can also mention the fact that the 8-week difference between the chronological and the developmental age was recovered over the following 6,5 months of kinesiotherapy. The infant was monitored until he turned one year of age in order to seize the verticality process up to the acquisition of walking.

Due to the fact that the assessment and exploration methods were objective, the results gathered are concrete, demonstrating the efficiency and importance of kinesiotherapy in a premature newborn.

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