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THE ROLE OF PHYSIOTHERAPY IN THE DELAY OF MOTOR DEVELOPMENT IN EARLY CHILDHOOD

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ABSTRACT

Motor development refers to the progression of motor skills in children, from simple to more complex movements. It involves the coordination of muscles and nerves to perform activities such as crawling, sitting, walking, and running. Proper stimulation and early interventions are essential for healthy motor development. Physical therapy plays a crucial role in the treatment of delayed motor development, using specific techniques to stimulate motor and sensorimotor skills. Interventions such as kinesiotherapy and proprioceptive exercises help improve postural control and motor coordination. Continuous and personalised monitoring is essential to promote gradual and significant progress. This clinical case study was conducted at the Physical Therapy Teaching and Research Clinic of the Iguaçu University. This is a descriptive, analytical and qualitative study, which used data obtained through anamnesis and physical evaluation to apply proprioceptive and kinesiotherapeutic resources in sensorimotor stimulation and postural control of the patient. The results were positive, with the range of trunk control, position of four supports and ability to crawl. It is concluded that the physical therapy protocol adopted promoted gradual improvements in motor development, emphasizing the importance of continuity of stimulation and treatment.

Keywords: Physical Therapy, Motor Development, Kinesiotherapeutic Conducts.

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INTRODUCTION

Human development is an age-related process that comprises continuous and complex changes. During this process, numerous psychomotor skills are developed, which progress from simple and disorganized movements to highly complex skills.[1] Changes in the physical, neurological, cognitive, and behavioral structures of the individual during the process of child development are considered to be long-lasting.[2]

According to the World Health Organization (WHO), human development begins at conception and continues until death, encompassing physical growth, neurological, behavioral, cognitive, social, and affective maturation. This process results in an individual being able to respond to their needs and those of their environment, considering their life context. [2]

Child development can present itself in two ways: Typical, considered within expectation, or delayed. Delay is considered when the child does not perform motor skills that are expected for each age group.[3] According to the Ministry of Health, about 12% of Brazilian children up to five years of age are suspected of having developmental delay, not demonstrating the behaviors and skills expected for this age group.[4]

In the first year of life, motor development is considered an important manifestation of the integrity and functionality of the central nervous system.[5] The emergence of momentum and its control occur in a cephalocaudal and near-distal direction.[6]

Some factors are considered risk for child development. In the case of motor development, these risk factors refer to a series of biological or environmental conditions that increase the possibility of deficits in the child's neuropsychomotor development.[6]

Some unfavorable environments do not offer adequate opportunities for the child's development.[5] To achieve child development properly, it is essential that the environment is favorable and stimulating, enabling social interaction, experiences of discovery and motor experiences.[7] Preterm children with low birth weight are considered to be at risk for child development, being capable of affecting the rhythm and quality of motor and cognitive acquisitions in early childhood, which can extend into the long term.[5]

In the process of dynamic coexistence between man and the environment, activities are controlled through the capture of information by the visual system.[8] Based on James Gibson's ecological theory, the individual energetically exploits the environment. It is understood that the environment in which children are inserted and the stimuli proposed for tasks directly influence the learning of new skills. Early detection of delay in the child's

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motor development is extremely important so that the necessary interventions to develop their visual and motor functions occur.[9]

To evaluate the delay in motor development, it is necessary to consider beyond clinical investigation, because when used alone, it is pointed out as ineffective. Proven scales should be associated with clinical investigation to identify neuropsychomotor alterations. The *Alberta Infant Motor Scale* (AIMS) is considered an instrument that qualifies "broad motor skills, the sequence of motor development and the control of antigravity muscles in prone, supine, sitting and standing postures, in children born at term and preterm". [10]

Motor physiotherapy programs in babies, term or preterm, in the phase of brain plasticity is pointed out as effective. This program can be considered more satisfactory when carried out together with the family, with intervention activities being proposed at home with parental interactions.[11] Physical therapy interventions, when performed early, present satisfactory result rates. When there is a diagnosis of delayed motor development, physiotherapy has as its main objectives to promote this development, thus minimizing the pathological aspects present.[12] Physiotherapy promotes integration dynamics, playful activities with colorful toys, balls and body movements, as well as games that work on balance. [13]

Motor Physiotherapy in child development aims to develop the congenital or acquired neurological system, with the help of manual and kinetic techniques being applied in isolation or with playful instruments.[14]

The proposed physical therapy treatment focused on offering special attention to motor delay, which was incompatible with the patient's chronological age, due to the fact that she was preterm.

This study aims to evaluate the functional evolution of the stages of psychomotor development in a 5-month-old child (age corrected to 9 months), treated for 3 months at the Physical Therapy Teaching Clinic of the Iguaçu University.

MATERIALS AND METHODS

TYPE OF STUDY

This study followed the methodology of a case study, carried out at the Physical Therapy Teaching and Research Clinic, Iguaçu University – Rio de Janeiro, in the

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Undergraduate Physical Therapy course, with the diagnosis of delayed motor development in a 9-month-old child.

VENUE

The study was carried out at the Physical Therapy Teaching and Research Clinic, Iguaçu University/Physical Therapy Graduation, - Avenida Abílio Augusto Távora, 2134 – Jardim Nova Era, Nova Iguaçu, RJ, Cep: 26275-580, Tel.: (21)2765-4053.

METHODS

Evaluation Methods

The following information was anamnesis performed and collected: Medical Diagnosis (DM), Main Complaint (QP), History of Pregnancy, Labor and Birth (HGPN), Past Pathological History (PPH), History of Current Disease (HDA), Food History (AH), Medication History (MH), Immunization History (HI), History of Growth and Development (HCD), Family History (FH), Socio-Environmental History (HS), Vital Signs, Physical Examination (Inspection, Palpation, Perimetry), Muscle Strength Test, Measurement, Specific Tests: Alberta Scale, Functional Kinetic Diagnosis, Objectives, Prognosis and Treatment.

Treatment Methods

- Bobath Method

Treatment Evolution

- Trunk support and control;
- Stimulus for four-legged stance and crawling;
- Encouragement to sit with and without supports;

MATERIALS

Materials for evaluation

- Sphygmomanometer and Stethoscope (Premium);
- Oximeter (Contec);
- Termômetro (G-tech);
- Metric fit (Macro life);

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- Martelo Neurológico Buck (MD).

Materials for treatment

- Mirror;
- Horsy;
- Chair with backrest;
- Roll;
- Doll/lion stroller;
- Release ball;
- Beans, sand and artificial grass.

Ethical Considerations

This study was carried out with the consent of the patient's mother, who signed the FREE AND INFORMED CONSENT FORM, allowing the use of the data to describe the clinical case report. According to the CEP/CAAE: 51045021.2.0000.8044.

PRESENTATION OF THE CLINICAL CASE

ANAMNESIS

In the present study, the sample consisted of a child with delayed motor development, who was integrated into treatment at the UNIG Physical Therapy Teaching and Research Clinic.

- **Personal Data:** 9 months, female, born on 03/11/2024, evaluated on 12/08/2023.
- **Medical Diagnosis:** Delay in motor development.
- **Main Complaint (QP):** "I notice that she has little support to sit on and little trunk support".
- **History of Pregnancy, Labor and Birth (HGPN):** Planned pregnancy, being the 1st pregnancy, at 28 years of age. The pregnancy was discovered at five weeks. No history of miscarriages. She reported having undergone prenatal care, but was unable to specify the exact number of consultations. He made use of folic acid, vitamin iron and calcium. He underwent all ultrasound exams. During pregnancy she was diagnosed with preeclampsia and after delivery with HELLP syndrome. On November 3, 2023, the mother was admitted to the emergency room of the Caxias D'OR hospital with a peak pressure and epigastralgia, and the interruption of

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pregnancy was scheduled at 36 weeks and 2 days. Cesarean delivery. The route bag time was on the spot and the apgar was 8/9. The newborn's weight was 2115g, length 43cm and head circumference of 32cm. The patient was hospitalized in the Neonatal ICU for 10 days due to low weight and weak suction. The corrected gestational age on the day of discharge was 37 weeks and 6 days.

- **Past Pathological History (PPH):** Uneventful.
- **History of Current Disease (HDA):** Mother reports that she sought pediatric care when she observed delay in the child's motor development at 8 months of age. He observed that she had difficulties to support her trunk, to stay in the position of four supports and when she showed interest in objects, she rolled until she reached them. He informs that he can still only stay in sedation for a minute, not supporting himself and leaning forward and falling. In July 2024, she was referred to physiotherapy by the pediatrician for evaluation of the delay in motor development.
- **Food History (AH):** The child is an infant. The introduction of food began at 5 months with fruits, at 6 months salty solids were introduced at lunch and at 7 months dinner was introduced.
- **History of Immunization (HI):** According to the vaccination booklet, all vaccines have been administered correctly to date.
- **History of Growth and Development (HCD):** A 9-month-old patient does not perform the four-legged position, does not crawl, does not remain in a sedation for a long time, and is unable to push furniture to stay in the orthostatic position.
- **Family History (FH):** Parents do not have comorbidities. The patient's mother was 36 weeks premature. Maternal grandmother is hypertensive maternal grandmother without comorbidities. Paternal grandmother is diabetic and paternal grandfather is hypertensive.
- **Socio-Environmental History (HS):** Lives in a two-story single-storey house, with his maternal parents and grandparents and a pet (dog). The residence has electricity, basic sanitation with a paved street and regular garbage collection.

PHYSICAL EXAMINATION

Vital Signs

In the first evaluation, it was not possible to measure the vital signs, because she was very agitated, and only the axillary temperature (36.5° C) was checked.

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Inspection

Normocored skin. It has a mongolic spot in the proximal lateral region of the left arm.

Palpation

He does not present pain on palpation. Preserved muscle tone.

Joint Test

It was not possible to measure it through goniometry, but there were no joint blocks.

Muscle Strength Test

Grade 4 muscle strengths for lower and upper limbs.

Anthropometric Measurements

Table 2 – Length measurements of upper limbs and lower limbs

Right Upper Limb	19 cm
Left Upper Limb	19 cm
Right Lower Limb	30 cm
Left Lower Limb	30 cm

Source: Evaluation carried out on 08/12/2024.

Specific Test

Table 3 – Alberta Scale

Positions	**Scores**
Prone	6 points
Supine	6 points
Sitting	2 points
Standing	6 points
Total	20 points

Source: Evaluation carried out on 08/12/2024.

According to the *Alberta infant motor scale* (AIMS) the patient's motor age is 5 months and she has a motor delay of 4 months of age.

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FUNCTIONAL KINETIC DIAGNOSIS

The patient has a psychomotor development incompatible with her chronological age, evidencing failures in the execution of stages of motor development. Stages of motor development not performed include:

- Motor delay of four months;
- It does not remain in four supports;
- It does not crawl;
- She does not transfer to sit and when placed in a sitting posture she can control the trunk with upper limbs in forward extension (protective reflex);
- It does not present transfer to the orthostatic posture;
- Absence of plantar arch.

PROGNOSIS

Favourable.

THERAPEUTIC GOALS

Short Term:

- Stimulate the four-support position and crawl;
- Encourage waist dissociation.

Medium Term:

- Improve trunk and lower limb balance;
- Stimulate laying transfer.

Long Term

- Stimulate orthostatic posture;
- Start walking.

THERAPEUTIC CONDUCT

- Waist dissociation: The child was placed on the therapeutic horse, the therapist's hands supporting the iliac crest, keeping the lower limbs flexed at 90° with full foot support on the surface. Where she was stimulated to pick up objects in different directions requested.

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- Stimulation for four supports: Placed on four supports on the foam roller, the LLM and hips flexed at 90° and the upper limbs in extension with the hands resting on the ground. Head and cervical in extension. Taking advantage of the position of four supports, the child was trained in the movement of crawling. The roller was used as a support and throughout the evolution, it was removed.
- Transfer from the sitting position to standing: With the hip and knees bent at 90° and the feet resting on the surface, the therapist positions the hands below the popliteal fossa region, applying a stimulus in the anterior direction to induce the orthostatic position.
- Stimulation of the plantar arch: Stimulation with different textures was performed on the sole of the foot, starting with the ball release. While the stimulus was performed, the child's hallux was kept in extension.
- Gait training with the help of the lion cart

Note: All exercises were performed in front of the mirror, using playful toys with sounds and vibrant colors, always accompanied by verbal stimuli for the child. The duration of the exercises respected the child's tolerance time.

DISCUSSION

According to Resena *et al*., by understanding the functioning of an individual's central nervous system (CNS), it is possible to plan activities that stimulate specific areas of the brain, thus promoting the development of new skills. In other words, by using this theory, we understand that it is possible to stimulate structures related to the motor and cognitive areas.[15] For Gerzson *et al*., the environment in which the child is inserted is a determining factor for his or her development, understanding that an unfavorable environment, without adequate stimuli, can restrict the pace of development, creating a barrier between the child's learning and motor acquisitions.[16]

Defilipo *et al* believe that changes in the child's motor development can be prevented with early interventions, focused on the environment in which the child lives, as it is in this environment that he develops as a social and individual human being.[17] Formiga *et al.* consider that early interventions are those that begin before the installation of abnormal posture and movement patterns.[18] The physiotherapist plays a crucial role in children's motor development, working with human motor skills not only in cases of pathologies, but

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also to adapt child development.[11] Formiga et al., corroborate Andrade when they state that interventions centered only on the child, without considering the family aspect, are less effective in development. [18]

According to Weinert *et al.,* in the first twelve months of life, human motor skills are evaluated almost monthly, showing broad and significant evolutions, moving from decubitus to ambulation. Pediatric neuro physiotherapy evaluates and identifies the stage of motor development in which the child is, with the aim of detecting delays or evaluating the evolution after a period of physiotherapy treatment.[19]

Silva *et al.,* state that physical therapy in conjunction with play makes care more tolerable and facilitates the interaction between physical therapist and child. In addition, it considers that through playful activities and social interaction that the child will develop their motor and cognitive skills progressively. The playful instrument as therapeutic adjuvants present benefits to the pediatric population.[20] Caricchio complements Silva et al. by stating that, in pediatric care in physiotherapy, there are several materials and equipment that can be used in a playful way, such as balls, rollers, mirrors, balance boards, treadmills, among others. [21]

Almeida *et al.* highlight the importance of mirror therapy during physical therapy treatment, as this technique activates the mirror neuron system and the primary motor cortex, promoting cortical reorganization. In addition, it stimulates the interaction between the visual and kinesthetic systems, resulting in functional and motor gains.[22]

According to Rodrigues et al., Bobath's neuroevolutionary concept (CNB) is responsible for inhibiting abnormal tone patterns, facilitating the emergence of a normal pattern and promoting active movements closer to what is expected. The CNB method has an influence on motor skills, improving an atypical percentage to a typical percentage. [23] Santos *et al.* corroborates Rodrigues et al. when they state that the Bobath method has the premise of improving function, improving postural control, balance and movement through facilitation. [24]

According to Souza *et al*, it is of great value to provide sensory stimuli to the child with different textures, such as: sponges, cotton, etc. It is stated that when there are risk factors for motor development, it is extremely important that the action takes place early, strengthening the neuronal network. The later the stimulation is started, the greater the impact on motor development.[25]

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Pretto *et al.* state that gait develops as the child progresses through the stages of rolling, sitting with and without support, dragging, crawling, standing, and walking with and without support, until he or she develops the ability to walk bipedally. Children without delayed motor development begin ambulation around 13 months, with variations accepted between 10 and 15 months. When there is a delay in the onset of gait, it is important to provide experiences that stimulate motor performance, as well as postural reactions of balance and stability. [26]

Casaes *et al.* They state that the role of physical therapy is to facilitate the acquisition of motor development, minimizing as much as possible the interference of reflexes, contractures and deformities, with the aim of promoting the greatest possible independence. Physical therapy aims to inhibit abnormal reflex activity, normalize muscle tone, and facilitate normal movement, consequently improving strength, flexibility, range of motion (ROM), and basic motor skills for functional mobility. The goals of a rehabilitation program are to reduce disability, prevent contractures and deformities, and optimize function. [27]

Lima et al. state that for an environment to be considered conducive to the child's development, it is not only about having the characteristic of a home, but also about providing interaction with parents, varying stimuli. When there is an environment that enriches stimuli, the child will have opportunities for perception and exploration, leading motor action and favoring affordances. [28]

RESULTS

In the evaluation carried out on August 12, 2024, the mother reported as the main complaint "little support to sit and little trunk support". After three months of physical therapy treatment, the following results were observed:

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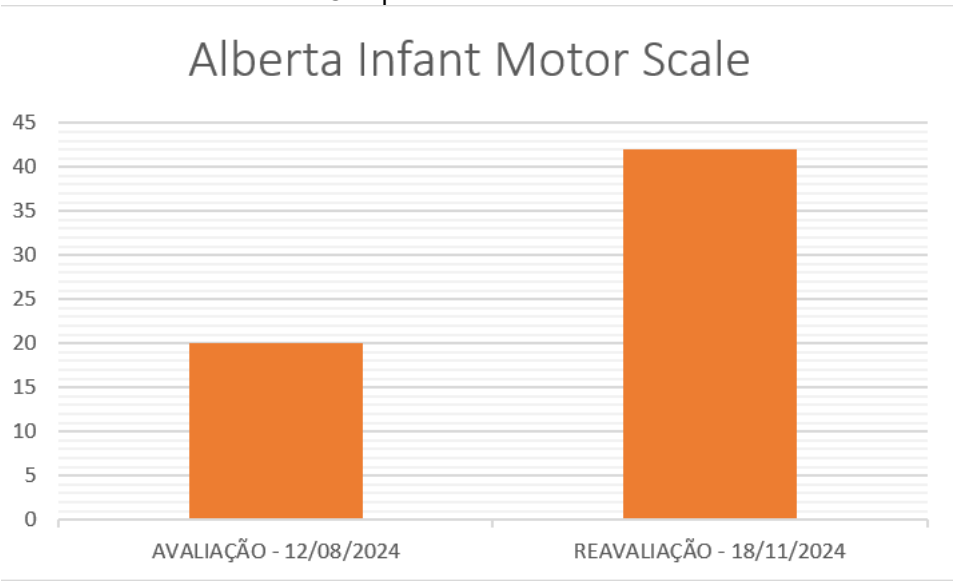
Table 4 - Comparison between Alberta scale



Source: Initial and final evaluation

Currently, the patient is 1 year (12 months) of chronological age. In the reassessment using the Infant Motor Scale, he obtained 42 points, corresponding to a motor age of 10 months. With the physical therapy intervention over 3 months of care, there was a gain of 5 months in motor age, with a motor delay on the day of the reassessment of 2 months.

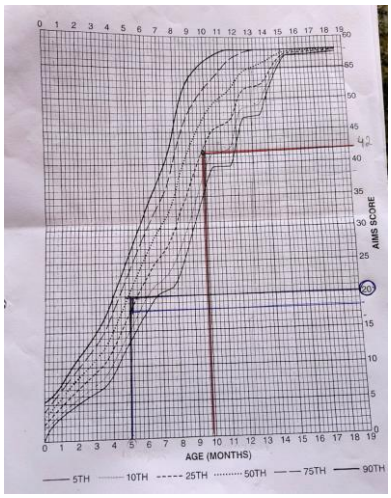


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Chart 5 – Comparison between anthropometric measurements:

SEGMENT	12/08/2024	18/11/2024
Right Upper Limb	19 cm	22 cm
Left Upper Limb	19 cm	22 cm
Right Lower Limb	30 cm	33 cm
Left Lower Limb	30 cm	33 cm

Source: Initial and final evaluation

Images of the physiotherapy approach:

Figure 1 - Sitting on the horse, with the feet supported for cervical control and waist dissociation.

Figure 2 – Position on all fours with the help of the foam roller and receiving stimulus to crawl.

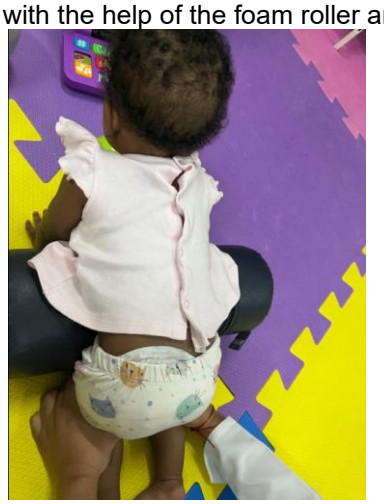

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Figure 3 - Stimulation of the plantar arch with different textures.

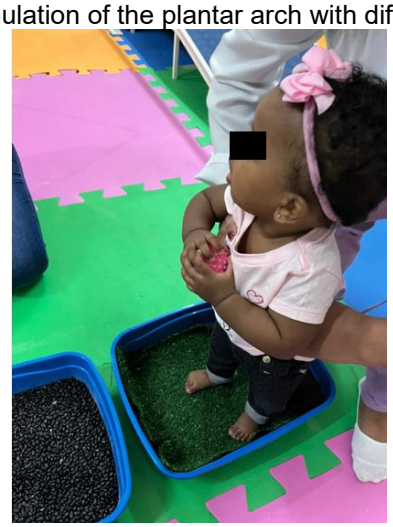

Figure 4 – Bipedal posture, holding the lion cart and receiving stimulation to perform the gait

Figure 5 – Bipedal posture, holding the parallel bar with assistance and receiving stimulus to perform gait.

CONCLUSION

The limitations resulting from the delay in children's motor development directly influence the child's life, restricting their motor skills and the exploration of the environment in which they are inserted. This prevents daily discoveries that contribute to the evolution of her development, making her even more dependent on her parents. Delay in motor

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development is not always related to a particular pathology. In some cases, the delay is associated with low stimulus and the socioeconomic conditions in which the child lives.

Physical therapy intervention is essential to improve the quality of life of children with delayed motor development, especially when performed early. The objective is to stimulate independence in functional and cognitive development, facilitating evolution, reestablishing the stages of motor development and preventing complications.

During the evaluation, the main concern was to promote the advancement of the patient's motor age. The treatment lasted 3 months and we faced some difficulties, such as appointments in which the patient was not cooperative, absences due to weather conditions and illnesses. However, the reassessment showed satisfactory results, with the patient reaching motor development milestones, such as crawling and sitting without support, exceeding the expectations of the caregivers.

It is concluded that physiotherapeutic intervention is essential and gradual for the motor development of children with delay, being essential for the improvement of quality of life and the discovery of new motor and cognitive experiences. Considering the importance of treatment, it is essential to guide and encourage the family to continue during daily activities.

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