

# Motor stimulation protocol for children and adolescents 4 to 17 years old in an outpatient clinic for persons with Down's syndrome

Cristiane Gonçalves da Mota<sup>1</sup>, Cristiane Vieira Cardoso<sup>1</sup>, Leandro Lanchotti Cavalcante<sup>1</sup>, Ednaldo Ardelino<sup>2</sup>, Katia Lina Miyahara<sup>3</sup>, Patricia Zen Tempski<sup>4</sup>

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## ABSTRACT

The motor development stage is the period in which children explore their motor skills and, depending on the stimulation of the environment and the proposal of tasks, they may achieve a satisfactory global development. Children with Down's Syndrome can achieve satisfactory and even adequate development for their chronological age if they receive the appropriate stimulation, even if late in acquiring motor skills. In adolescence, the work of motor development should be continued with specialized activities such as sports so that the development acquired is maintained and refined. The objective of this article is to present the motor stimulation program developed at the HCFMUSP Physical Medicine and Rehabilitation Institute. It is believed that an appropriately structured motor stimulation program for children and adolescents with Down's Syndrome acts as an important means of intervention to provide the proper development of essential and specialized motor skills.

**Keywords:** Child, Down Syndrome, Motor Activity

<sup>1</sup> Physical Educator, HCFMUSP Physical Medicine and Rehabilitation Institute - Lapa Unit.

<sup>2</sup> Therapeutic Workshop Technician, HCFMUSP Physical Medicine and Rehabilitation Institute.

<sup>3</sup> Physiatrist, Director of the HCFMUSP Physical Medicine and Rehabilitation Institute - Lapa Unit.

<sup>4</sup> Pediatrician, Coordinator of the Outpatient Clinic for the Care of Persons with Down's Syndrome, HCFMUSP Physical Medicine and Rehabilitation Institute.

### Mailing address:

Instituto de Medicina Física e Reabilitação HCFMUSP  
Cristiane Gonçalves da Mota  
Rua Guaicurus, 1274  
São Paulo - SP  
Cep 05033-002  
E-mail: cristiane.mota@hc.fm.usp.br

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## INTRODUCTION

The child development process is an area that is being studied more deeply in recent decades, in which research has been directed to value the organic and individual diversities of each individual during his life.<sup>1</sup>

Motricity is the relationship of various motor functions (perceptual-motor, neuro-motor, psycho-motor) of vital importance to the global development of the child, for it is through the exploration of movements that the child develops awareness of itself and of the external world, achieving thus its own independence.<sup>2</sup>

In regards to children and adolescents with Down's Syndrome (DS), it is known that they are delayed in the acquisition of motor skills, but full development can be achieved.<sup>3</sup>

In that sense, we believe that the promotion of motor activity to the person with DS is essential by being a facilitator in the acquisition of autonomy, in addition to helping their maturation and in maintaining their health.

To prepare the Motor Stimulation Program, a bibliographical review was made based on scientific data from LILACS, Scielo, and Pubmed, using the keywords *síndrome de Down* (Down's syndrome) and *desenvolvimento motor* (motor development), and searching in reference books for the evaluation of motor development. The articles and books reviewed were published in the period between 1991 and 2010. The data were analyzed and thus determined the following theoretical assumptions on human development.

## MOTOR DEVELOPMENT

Motor development occurs in a continuous, sequential, and progressive manner.<sup>4</sup> At the moment of conception, the human organism has its biological logic determined and thus various modifications occur until adulthood.<sup>2</sup>

Movement is the center of active life for children, the primordial period in all the aspects of their development as much in the motor and emotional domains as in the cognitive.<sup>5</sup>

The motor development phase is the period in which the child is involved in testing its motor skills, hence a diversity of movements should be explored so that the child tries to perform them in the best way possible.<sup>5</sup>

Gallahue & Ozmun<sup>5</sup> divide motor development for children into a fundamental motor phase and a specialized motor phase, beginning at two years of age.

### Fundamental Motor Phase

Characterized by the phase in which the child is involved in exploring and testing its motor capacities, going through a period of discoveries in which it learns and reacts with motor control to the stimuli received.

Some activities of the fundamental motor phase are: locomotion skills such as running and jumping, manipulative skills such as throwing and catching, and stabilizing skills such as walking on one foot.

This phase is divided into stages:

**Initial stage:** Movements show an incorrect sequence, with limited or exaggerated use of the body, with no rhythmic control and coordination.

**Elementary stage:** Movements have more control and rhythmic coordination, but still with restricted and exaggerated use of the body. This is generally seen in three- to four-year-old children.

**Mature stage:** Movements are now efficient, controlled, and coordinated. It is expected that children enter this stage at five to six years of age, but, many children and adults do not develop their fundamental motor skills by this stage, for many individuals need the opportunity to practice these skills in an environment that promotes learning.

Maturation is important for the development of fundamental movement patterns, but environmental circumstances (opportunities, emotional incentives for the practice) are also important in this process.<sup>5</sup>

### Specialized Motor Phase

Still according to Gallahue & Ozmun,<sup>5</sup> in this phase the fundamental stabilizing, locomotive, and manipulative skills are refined progressively to be used in complex situations. An example of this would be the ability to hop on only one foot, but in the specialized movement phase, this could be practiced jumping rope at the same time. This phase, according to the authors, is also subdivided into three stages:

**Transitory stage:** the child (approximately seven or eight years old) initiates the combination of motor skills fundamental to the specialized motor skills in sports or recreation. For example: jumping rope and playing ball at the same time.

**Application stage:** the child (approximately 11 to 13 years old) is growing in cognitive development that makes it capable of making various learning decisions. For example: if the child in this phase likes team activities or game strategy, it may decide to specialize in playing basketball. At this stage, children start to avoid or seek participation in specific activities.

**Permanent usage stage:** This stage starts at approximately 14 years of age and continues into adulthood. It represents the pinnacle of the motor development process. The competences acquired and choices made in the previous stages will be applied in daily, recreational, and sporting activities throughout life.

Children with some special, physical, or mental need may show some delay in their motor and cognitive development; however, they can achieve efficient performance in conformity with their chronological age even with control complexities to perform and in the adjustments accommodating modifications in the demands of the task and of the environment.<sup>3,6</sup>

In addition to DS, associated disorders can intervene in the achievement of motor skills, sometimes leaving those affected with learning disabilities.<sup>3</sup>

It is believed that muscle hypotonia is closely related not only to this sphere of development, but also to the fine and global motricity, as well as to the acquisition of speech and cognitive development, which normally is called Global Developmental Delay.<sup>3,7</sup>

One study compared the functional performance of children at two and five years of age with and without DS; its results showed that the functional performance of children with DS is lower than that of other children, but this fact does not remain constant during their development. It was observed that, at two years of age, this difference is more evident than at five years of age and that, as the child with DS acquires motor skills, such skills integrate into their day to day repertoire, favoring their autonomy.<sup>8</sup>

In this way, we believe that motor stimulation programs should include children and adolescents, since specialized motor development is continued throughout life.

## MOTOR STIMULATION PROTOCOL

In the Outpatient Clinic for the Care of Persons with Down Syndrome, the service of

Physical Conditioning is understood as an integral part of rehabilitation, acting along the multiprofessional team with the following objectives:

**Promoting health:** The promotion of health occurs through health education, in which the patient and his family are made aware of the importance of practicing physical exercises to maintain the health of the person with DS, in order to improve cardiorespiratory conditioning, body weight, and muscle tone.

**Building autonomy:** Autonomy is built in synchronicity with exercising, for in achieving physical improvement the individual achieves greater independence in his daily life, which shows the need for a continued practice, even after the program is over.

**Social integration:** With the practice of physical exercises, the person with DS will have an opportunity to discover his potential, achieve motor skills, and socialize with a group. This could contribute to social integration.

We were guided by the theoretical assumptions of expanded, integrated, and shared clinical care seeking the humanization, autonomy, and acting of the individuals in health practices.<sup>9</sup>

## PREPARATION OF THE EVALUATION AND INTERVENTION METHOD

The child development standard is essential to the preparation of a motor intervention program, because in this way it is possible to confirm which motor skills should be emphasized.<sup>8</sup>

There are some instruments that are commonly used to evaluate the child's motor development such as: Motor Development Scale (MDS),<sup>2</sup> Test of Gross Motor Development (TGMD 2),<sup>10</sup> and the motor development classification model proposed by Gallahue & Ozmun.<sup>5</sup>

The Motor Development Scale (MDS) was prepared by Rosa Neto<sup>2</sup> and evaluates the motor development through a set of diversified and complex tests in which the difficulties in the areas of fine motricity, global motricity, balance, body schema, spatial organization, temporal organization, and laterality are identified.

The TGMD-2<sup>10</sup> was an instrument created by Ulrich in 1985 (initially named TGMD and,

in 2000, renamed as TGMD-2) that seeks to identify children who have some delay in the development of fundamental motor skills; it also evaluates the individual process in the development of these skills.<sup>10</sup>

Although we consider it an excellent evaluation method, the TGMD-2 is not used in our service because it demands a space with a minimum length of 50 meters and specific materials.

The motor development classification model is a descriptive model that shows the intentional function of the movement task in the three classes of fundamental skills: Stabilizing Skills, Locomotion Skills, and Manipulative Skills; it also facilitates the classification of individuals into initial, elementary, and mature stages of development of these motor skills.<sup>11</sup>

Our service was based on the proposal by Gallahue & Ozmun<sup>5</sup> because this method illustrates the sequence of development of fundamental motor standards.

## EVALUATIVE METHOD

The initial evaluation in our service is based on the model by Gallahue & Ozmun<sup>5</sup> that illustrates the sequence of appearance of fundamental movements in children up to seven years of age. In this model, the evaluation is based on the identification of the fundamental motor skills according to the approximate age at the onset of the evaluation.<sup>5</sup>

Our evaluation proposal uses the motor skills identification model, but expresses results in percentages, quantifying how much motor development has been reached for the age. Quantifying the motor development facilitates the child's follow-up significantly.

For this, we develop a quali-quantitative analysis model observing and qualifying the motor skill with four possible answers: not performed (NP), performed in the initial stage (PIS), performed in the elementary stage (PES), and performed in the mature stage (PMS).

The evaluation is composed of 14 items, with two items to evaluate stabilizing skills, eight items to evaluate locomotion skills, and four items to evaluate manipulative skills, as shown in Chart 1.

In the fundamental motor phase there is a total score to be achieved according to the chronological age of the child; based on that score, we quantify the child's motor development.

Different from the model by Gallahue & Ozmun,<sup>5</sup> our proposal quantifies the motor skills expected for the chronological age of the child. A re-evaluation is made every three months after the beginning of the program.

Thus, using the evaluation model of the scale proposed by our team, we obtain a result of the motor development stage for each skill evaluated. This allows us to prepare a report on the motor diagnosis that is discussed in a multidisciplinary team meeting and that will be part of the situational diagnosis of the patient. The therapeutic goals for our service are defined in the individual care plan according to this situational diagnosis.

The evaluation adapted by the HC FMUSP Physical Conditioning service is applied to individuals with DS from 4 to 17 years of age, although the original model by Gallahue & Ozmun<sup>5</sup> was limited to seven years of age, due to the lateness that persons with DS show in reaching motor milestones.

## INTERVENTION

Based on the theoretical assumptions of Gallahue & Ozmun,<sup>5</sup> the proposal of our motor stimulation program is to promote the development of fundamental motor skills and, with the maturing of these skills, provide the development of specialized motor skills.

With this in mind the program consists of activities that seek the maturing of stabilization, locomotion, and manipulative skills, as shown in Chart 2.

The motor stimulation program for specialized skills will only be developed if the person has mature fundamental motor skills or the potential for it; that is, when it is notable that the real achievement of maturity will only depend on factors such as the task, the individual, and the environment, since the development of fundamental motor skills is a pre-requisite for the acquisition of specialized motor skills.<sup>5</sup>

During the transition from the matured fundamental stage to the specialized phase, the motor pattern will be more refined, with few changes in the manner of execution and the improvement in the performance being evident year after year with an increasing repertoire of physical motor skills.<sup>5</sup>

Therefore, we believe that in addition to sports initiation, activities that provide an increase of skills (precision, exactness, control) will contribute to this transition process between one development stage and the next.

**Chart 1.** Partial model for manipulative skills evaluation

Manipulative Skills					
Movement pattern	Description	NP	PIS 2-3 years	PES 3-5 years	PMS 6 years
11 - Throw from above (Throwing)	Involves applying force on the object in the desired direction				
Movement pattern	Description	NP	PIS 2-3 years	PES 3-4 years	PMS 5-6 years
12 - Kick	Involves applying force on the object with the foot				

**Chart 2.** Proposal to develop fundamental motor skills

Activity	Objective
Standing on a balance beam, getting up from the floor without using the hands, standing on only one foot, playing hopscotch. Walking on a line marked on the ground, walking on a cord on the ground, walking on a mattress, walking on a balance beam (using all the directions).	Develops stabilization skills (static balance)
Walking on a line marked on the ground, walking on a cord on the ground, walking on a mattress, walking on a balance beam (using all the directions).	Develops stabilization skills (dynamic balance)
Jumping down from low objects, jumping from one arch to another arch on the floor, running from one point to another of the room in search of a specific object.	Develops locomotion skills
Throwing and catching objects (balls, arches, shuttlecocks) in various sizes and shapes, kicking, conducting the ball with the feet.	Develops manipulative skills

Our service offers the following activities shown in Chart 3 to develop the Specialized Motor Phase:

Participation in sports activities such as soccer, basketball, tennis, and volleyball allows people in transition and application stages of specialized motor skills to refine their motor skills. These activities can be applied with rules, but playfully and without competitive purposes to favor socialization.<sup>5</sup>

The practice of capoeira, adapted to persons with DS, aids in the acquisition of motor coordination while working global motricity, balance, motor skills development, body schema, rhythm, laterality, and socialization, proposing new challenges every day.<sup>12</sup>

Dancing contributes to developing their body schema while working body expression and exploring various movements. With the use of music and rhythm, this activity can be performed as a recreation, facilitating socialization and providing pleasure in its practice.<sup>13</sup>

In addition to these activities, we offer the practice of swimming, since water exercises demand more respiratory effort, which generates an increase in the absorption of

oxygen through deep breathing making the respiratory system more efficient, diminishing the risk of diseases, and adding to the musculoskeletal strengthening induced by exercise.<sup>14</sup>

During the swimming classes, the individual is induced to bring attention to stabilizing his posture and, then, his mental capacity is expanded, favoring the acquisition of new postures and the global development of the body.<sup>15</sup>

The activities described are only a few suggestions of intervention, since we believe that other proposals with the same objectives may be developed according to the materials and environment available, and the creativity of the physical educator.

To initiate the work with children with DS we need to consider age, personal morbid antecedents, skills, and difficulties.<sup>16</sup>

We suggest that the classes be given to small groups and that the activities proposed be explained in a short and simple manner, which may result in a better performance, keeping in mind this population's facility to disperse attention and their difficulty to retain and follow orientations.<sup>3,16</sup>

It is important that the physical educator be flexible in the manner in which he offers the activities, since these children may refuse to do them and have mood alterations such as stubbornness and irritation.<sup>3</sup>

Finally, we emphasize that the activities recommended must consider the children's developmental stage, since although the acquisition of mature fundamental motor skills is associated with age, it does not depend on it, for individual and environmental factors can interfere.<sup>5</sup>

### Frequency and duration of the session

Our service offers 30-minute sessions once a week, which, in our experience, gives better results for the child than longer sessions, for in this way the children are not exposed to high levels of fatigue.

### Associated co-morbidities and their implications in the classes

In DS, some co-morbidities deserve attention from the physical educator due to the syndrome having some functional and structural characteristics that interfere with the practice of physical exercises. They are:

#### Characteristics associated to the locomotor system structures

The most frequent problems associated with the locomotor system structure are: ligamentous laxity and atlantoaxial instability.<sup>17</sup>

Atlanto-axial instability afflicts approximately 15% of this population and 2% of them may develop spinal cord compression.<sup>18</sup>

During early infancy and in other stages of life, the family should be oriented regarding the correct neck positioning of a person with DS to prevent spinal cord injury due to the atlanto-axial instability. Total flexing and extending movements of the cervical spine made in somersaults, dives, horse riding, and gymnastics should be avoided.<sup>9</sup>

El-Khoury et al.<sup>19</sup> investigated the presence of atlanto-axial instability in adults with DS and 11% of the individuals examined showed the instability. This result reinforces the importance of these persons being examined periodically, especially when they practice physical exercises.

#### Characteristics associated with the cardiorespiratory system structures

Approximately 40 to 50% of people with DS have congenital cardiopathies that some times require surgical intervention. These cardiopathies may cause limitations in the capacity to tolerate greater intensity and duration of motor activities.<sup>17</sup>

**Chart 3.** Proposal to develop specialized motor skills

Activity	Objective
Chest passing, overhead passing, dribbling, kicking	Football/soccer skills
Throwing, receiving the ball, hitting the ball with objects	Basketball/tennis skills
Blocking the ball, digging, hitting the ball with both hands overhead	Volleyball skills
Walking with rhythm in various directions, jumps, galloping, rotating the body	Dance/capoeira skills

### Characteristics associated with the central nervous system and the processing of information

Persons with DS may have problems in the sensory and perceptive systems such as visual and auditory difficulties.<sup>17</sup>

In addition to that, existing muscular hypotonia may cause difficulties in controlling and recruiting muscle fibers during physical exercise. Also, this population presents smaller cerebellum and basal ganglia, structures related directly to the control of rhythm, coordination, and balance, which compromises the acquisition of motor skills.<sup>17</sup>

### CONCLUSIONS

Persons with DS present delays in the acquisition of motor skills, although if they receive the appropriate stimulation, they can achieve a satisfactory development.

In the Outpatient Clinic for the Care of Persons with Down's Syndrome, the work in a multidisciplinary team establishes a situational diagnosis and an individual care plan for each patient in order to holistically promote the person's health, seeking their maximum potential for a full life.

The Physical Conditioning service at IMREA - HC FMUSP is an integral part of this team and its specific objective is to promote health, autonomy, and social integration through the practice of physical exercises.

The evaluation model proposed by our service represents an advance in the model suggested by Gallahue & Ozmun,<sup>5</sup> for it makes

it possible to quantify the motor development in the population of children with DS.

To evaluate the motor development of these individuals is important because it optimizes the follow-up of acquiring fundamental motor skills and guides more appropriate therapeutic proposals.

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