

Effect of the practice of body weight support in the motor function of children

Efeito da prática do suporte de peso corporal na função motora de crianças

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RESUMO | OBJETIVO: Avaliar a influência do Suporte de Peso Corporal (SPC) sobre a função motora de crianças não deambulantes. **MÉTODO:** Participaram do estudo oito crianças que não apresentavam o padrão de marcha. Foi realizada a identificação do desempenho da função motora grossa por meio da *Gross Motor Function Classification Measure (GMFM)* e da flexibilidade por meio do Teste *Flexiteste*, antes e após 10 sessões e um período de retenção durante 3 meses de tratamento com SPC em esteira ergométrica. Tendo assistência de dois terapeutas que auxiliavam em pontos chaves de joelho e tornozelo simulando o padrão de marcha da criança. As sessões foram realizadas uma vez por semana, durante 30 minutos, por um período de 3 meses e o mesmo de retenção. **RESULTADO:** O GMFM apresentou aumento das pontuações obtidas pré/pós-tratamento e retenção nos itens deitar/rolar e sentar, já o item engatinhar/ajoelhar mostrou diferença significativa apenas no período pré/pós-tratamento. A variável flexibilidade apresentou diferença significativa entre o pré e pós-tratamento e no pós-tratamento com o período de retenção. **CONCLUSÃO:** O tratamento com SPC em esteira ergométrica pode potencializar o desempenho funcional de crianças não-deambulantes, possibilitando a evolução de sua função motora grossa e flexibilidade.

PALAVRAS-CHAVE: Suporte de peso corporal. Marcha. Reabilitação. Criança.

ABSTRACT | OBJECTIVE: To evaluate the influence of the Body Weight Support (SPC) on the gross motor in non-ambulant children. **METHOD:** Eight children participated in the study, they did not present gait pattern (GMFCS IV and V). To access the gross motor function, the Gross Motor Function Classification Measure (GMFM) test was applied, the flexibility values were collected through flexiteste. Both tests were conducted before and after 10 clinical sessions and three months after the end of the treatment. The intervention were performed on a treadmill, with the subject attached to the SPC, being accompanied by two physiotherapists that helped to maintain the gait pattern by maintaining key positions of the knees and ankles. Each session had duration of 30 minutes, once per week during three months. **RESULTS:** The GMGM scores for lay down/roll and sit increased after the treatment and on the retention when compared with pre tests. The crawl/kneel score only presented difference after the end of treatment. Flexibility presented higher values for post and retention in comparison with pre tests. **CONCLUSION:** The SPC treatment during treadmill gait may potentiate the functional performance of non-ambulant children, improving the gross motor skills and flexibility.

KEYWORDS: Body weight support. March. Rehabilitation. Child.

Introduction

Gait is one of the fundamental processes in the life of a human being, and can generally be associated with the degree of functional independence of the subject and the quality of life¹. As it is a complex movement, it is a difficult process that involves the integration of different functions, mainly neurological and motor, for a satisfactory execution.

Pathologies that lead to neuromotor disorders often make it difficult to acquire gait; especially in children².

The child who does not have the ability to walk has neuromuscular changes, such as changes in range of motion, deformities, variations in muscle tone, spasticity, difficulty of transfer, among others³.

Such changes usually manifest with specific patterns of posture and movements that may compromise the functional performance of these patients⁴.

Consequently, difficulty in walking can significantly interfere with the child's interaction in relevant contexts, thus influencing the acquisition and performance of not only basic motor markers (rolling, sitting, crawling, walking), but also activities of the daily routine, such as bathing, feeding, dressing and mainly locomotion in varied environments⁵.

The gait training in children with neurological dysfunctions is difficult to perform because in many cases they are unable to produce the muscular strength necessary to maintain posture and walking⁶. Given this, it is necessary to provide support to protect these children from falling, to maintain the balance and thus, to carry out their rehabilitation. One of the viable alternatives to aid this process is the Body Weight Support (BWS)⁷.

The BWS is a suspension system, which partially holds the patient's weight and thus the gait is facilitated⁸. This system has been used for the rehabilitation of the gait of patients with encephalopathies³, spinal cord injury⁹, stroke¹⁰, down syndrome¹¹, myelomeningocele¹², among others⁸.

The majority of studies published previously analyzed only parameters related to the performance of the gait¹³, lacking studies that verify other effects

of gait training, such as gross motor function and flexibility, which are fundamental to patients' quality of life. The objective of this study, therefore, was to evaluate the gross motor function and flexibility in non-ambulatory children using the support of body weight in treadmill.

Method

Type of research

This is a single-arm, quantitative, and exploratory clinical trial. According to Dalfovo, Lana and Silveira¹⁴ it is classified as quantitative everything that can be measured in numbers, classified and analyzed, using statistical techniques, and being classified in exploratory research that has little information regarding the object of study.

Sample

Eight non-ambulatory children with different pathologies of both sexes, aged between 2 and 10 years, were randomly assigned to participate in the study. Participants who met the following criteria were included in the study: (1) GMFCS level IV or V; and (2) no cardiopulmonary dysfunction (3) will complete the proposed training. The following were excluded from the study: (1) excessive ligament laxity of the first cervical vertebrae (atlas-axis); (2) decubitus ulcers in the pelvic or lower limb region; (3) any other medical contraindication to the performance of the gait.

The evaluation and intervention methods used in this study were approved by the Ethics and Research Committee of the State University of Santa Catarina, through the opinion 1.218. 446. After the participants' choice, they were asked to sign a Free and Informed Consent Form, the authorization of the parents or guardians of the children selected for their participation in the study.

Procedure

An initial evaluation of the participants was carried out using an evaluation form prepared for the study, containing identification data, anamnesis and anthropometric and physical measurements. The following tests were then applied: assessment of flexibility through the application of Flexitest and

evaluation of gross motor function through the Gross Motor Function Classification Measurement - GMFM. The tests were applied on the first day of treatment and reapplied at the end of the last day and after a 3-month retention period.

Flexitest is a scale that consists of the measurement and assessment of the maximum passive mobility of movements of the body, encompassing the ankle joints, knee, hip, trunk, wrist, elbow and shoulder. Eight movements are made in the lower limbs, three in the trunk and the nine remaining in the upper limbs.

The numbering of movements is done in a distal-proximal direction. Each of the movements is measured on a scale increasing number of integers from 0 to 4, making a total of five possible values. THE measurement is made by the slow execution of the until reaching the maximum amplitude point and the comparison between the assessment maps and the maximum amplitude obtained by the evaluator not evaluated¹⁵.

Although the analysis of Flexitest is made for each movement in isolation, it is possible to add results and obtain a general index of flexibility, called Flexindex, ranging from 0 to 80 points. The description of this index is made as follows: A) very small flexibility, less than 20 points; B) small 21 to 30 points; C) negative mean 31 to 40 points; D) positive medium 41 to 50 points; E) large 51 to 60 points; F) too large, > 60 points. At the end of the evaluation, the the patient is classified according to the joint flexibility¹⁵.

The GMFM is a trust and sensitivity scale to discover important clinical changes in the the gross motor function of children with various neurological and motor pathologies through quantitative evaluation of functional tasks.

This test is composed of 88 items divided into five dimensions: A) Lying and rolling-formed for 17 items; B) Sitting-20 items; C) Crawling and Kneeling - 14 items; D) Standing- 13 items; AND) Walking, Running and Skipping- 24 items. Each item evaluated receives a score of 0 to 3, being: 0 - Inactivity of the child to the activity requested; 1 - Initiates the proposed movement in a independently, performing less than 10% of movement; 2 - Perform the movement partially 90% of movement and 3 - Completely

perform the suggested movement or posture¹⁶. At the end of the assessment are added to the points obtained by the in each dimension, converting to a percentage in relation to the maximum score in the dimension.

During the evaluation the children wore clothing that allowed total freedom of the movements. Each child was placed on a for physical therapy evaluation and were used toys to stimulate change decubitus and acquisition of specific postures. Was allowed child, a maximum of three attempts, being the spontaneous performance of any item considered valid. The verbal or demonstration of any item was allowed.

Therapeutic performance

The BWS treadmill treatment was performed at the Clinic School of Physical Therapy of the Center of Health Sciences and Sport of the University of the State of Santa Catarina- CEFID / UDESC Florianópolis / SC. The sessions were for 30 minutes once a week for 3 months, totaling 13 visits (3 evaluations and 10 sessions in SPC with ergometric treadmill).

The gait training was performed with a suspension partial weight (patient) to facilitate walking. The suspension was established in approximately 60 to 90% of body weight. The treadmill was applied with speed between 1 km / h and 3 km / h, depending on the comfort of the patient. To facilitate the movement of the gait, two therapists assisted in key points of knee and ankle, simulating the movements of lower limbs to promote walking in children. For measuring the percentage of a load cell was used extensometric, ring-shaped, maximum load / sensitivity of 3000/2 N and error less than 1% was fixed above the child by checking the weight of body suspension¹⁷.

Statistical analysis

To describe the quantitative variables, Descriptive statistics were used by means of and standard deviation. For the data that normal distribution was used the Anova test for repeated measures with the Bonferroni post hoc. For the data that did not have normal distribution Friedman's Anova was used, and the comparison in pairs was done through the Wilcoxon test. This one accepted the value of p

<0.05 for significance statistic and 95% confidence level. For all the SPSS 20.0 program was used.

Results

The sample of this study consisted of eight children, five with Cerebral Palsy, three with Mielomeningoceli. Of this total, five were of the sex males and three females, with a mean of age of 4.95 ± 2.33 years.

The difference between the means of the Flexitest test right and left are in Table 1. The values are related to the three evaluation periods: pre-treatment, post-treatment and retention. The variable flexibility of the right side body segment presented a significant difference between the pre- and post- and in post-treatment with retention, already the flexibility of the left side presented significant difference only between the pre and post.

Table 1. Classification of the sample according to its level of joint flexibility according to the Flexitest N = 8

	Pre-treatment	Post-treatment	Retention
Flexitest Right	29,5 ± 5,85	43,5 ± 8,16 ^A	33 ± 6,76 ^B
Flexitest Left	35 ± 7,22	46,5 ± 7,25 ^A	38 ± 8,58

A = Significant difference between pre and post treatment. B = Significant difference between post-treatment and retention.

The classification of the sample by function motor skills in relation to functional ability to perform lying and rolling motor tasks (dimension A), sit (dimension B), crawl and kneeling (dimension C), standing (dimension D) is in table 2. The analysis allows us to identify the causal link in advance and interdependence between intervening variables (treatment with support of body weight on treadmill) and dependent (gross motor function).

From the results presented in the scale of the motor function, it can be inferred that after the with SPC on

a treadmill improvements in motor skills, especially in the lying down / lying down, where all patients achieved an increase in their pre / post-partum percentage and retention ($p < 0.05$). Already in the dimension crawling / kneeling four children got significant increase in the score with mean pre- and post-treatment of 17.85% and posttreatment with the retention period did not present significant difference ($p > 0.05$). In the standing position three children were able to reach an average of 5.44%, however, showing no difference ($p > 0.05$).

Table 2. Classification of the sample according to the gross motor function N = 8.

	Pre-treatment	Post-treatment	Retention
Lying Down and Rolling	72,5 ± 27,5	86,25 ± 27,69 ^A	80,05 ± 24,36 ^B
To sit	47,5 ± 32,97	61,65 ± 34,02 ^A	56,95 ± 35,19 ^B
Crawling Kneeling	14,25 ± 27,98	32,1 ± 41,39 ^A	25,45 ± 34,15
Standing	1,27 ± 6,71	6,71 ± 11,77	3,72 ± 6,03

A = Significant difference between pre and post treatment. B = Significant difference between post-treatment and retention.

Discussion

From the results of this study, it was verified that patients who received of treadmill SPC on the treadmill ergometric parameters showed an increase in motor function (GMFM) and flexibility (Flexitest).

In assessing flexibility from the Flexitest the children got an increase in their scores with an average of 14 points in the segment of the right side and 11.5 points referring to the left side, compared pre / after treatment ($p < 0.05$), from one small flexibility for a positive average, the which demonstrates that therapeutic intervention with SPC favors the increase of joint amplitude of movement. According to Annunciato and Oliveira¹⁸ motor rehabilitation in patients who do not have the ability to walk has the function promote the best level of operation of the neuromusculoskeletal apparatus, promoting the adaptation of the patient to a new reality. It is believed that rehabilitation with the use of treadmill treadmill is considered to be a treatment to facilitate or improve the walking pattern.

No studies were found that correlated the variables SPC and flexibility with the intention of to compare gait training on treadmill with the partial weight suspension¹⁹, however, it is known that the greater the flexibility of the child, the better is the gait training²⁰.

The time of treatment of the children in this study was 30 minutes, suspension of 60 to 90% of the weight body and speed as comfortable as possible patient, ranging from 1 km / h to 3 km / h. Damian E Dejong¹³ who carried out a systematic review literature on the SPC in pediatrics state that the speed, treatment time and percentage of body suspension do not yet have criteria well defined. According to them, the which are used in most of the between 20 and 120 minutes, since the percentage of suspension is made from the good alignment of the trunk and limbs during with 15-90% suspension

body, and the speed of the treadmill should be that where the patient meets the standard of closer to reality. Having all This information is in accordance with the methodology used in the present study.

The sample of this study presents eight children with mean age of 4.95 years where they all obtained improvement in gross motor function in the dimensions of lying / rolling, sitting and crawling / kneeling and three children showed improvement in standing dimension. It is. In the study conducted by Begnoche and Pitetti²¹, where the walking training was carried out with SPC in five children with a mean age of 5.2 years, all presenting a diagnosis of paralysis cerebral, the treatment being performed during 4 weeks, lasting 60 minutes, and suspension performed until you reach an upright posture to allow full extension of the knee and hip, the treadmill speed was applied according to ability of the child to carry out the or without help from the therapist. As a result of study, all children will gain classification of GMFM in the dimensions of rolling, sitting and crawling / kneeling, and only one improvement in the standing level and another level, running and jumping, in addition to all children to increase their number of distance traveled.

The results found in the study in relation to to gross motor function (GMFM) are consistent with those observed in Schindl's research, Forstner, Kern and Hesse²² who undertook a study with the objective of examining the role of treadmill running on partial weight suspension in children with cerebral palsy. They took part 10 children (GMFCS I, II, IV and V). four male and six female, with an average age of 11.5 years. The children were submitted to three months of gait training in treadmill, with partial weight suspension, three weekly sessions lasting twenty and five minutes each. The researchers made use of the GMFM, items regarding standing posture and gait. The percentage of patients' weight loss ranged from 20% to 40%, according to the of each child, and with training, suspension of the weight was

gradually reduced. The results found in the treatment obtained an improvement signifier in the GMFM standing item with an increase of 47% and in the item walking, running and skipping an improvement of 50%. The results found in this study were should for the longest treatment time 25 minutes and number of sessions held per week, 36 visits, and the population is homogenous. At the However, we could observe improvement in the standing item, with an increase of 5.44%, of three children. Leading taking into account the number of visits, and the population under study can be satisfactory from the clinical point of view.

It is also important to note that although non-ambulatory children studied can not have a prognosis of gait, the clinical signs are modify as the central nervous system matures and the child grows. The engine system undergoes changes due to the maturation process in relation to learning and the influence of the environment. This, the importance of brain plasticity in this type of treatment is present, thus occurring, an adaptive change in the structure and function of nervous system, which can occur in any stage of life, as a function of interventions with the internal and external environment²³.

According to Sheperd²⁴, the acquisition of motor control and motor skills is acquired from the progressive modification of the nervous system, which is characterized by the changes that are synaptic connections, and these connections are in the dependence on the use and therapeutic manipulation.

An early treatment for counting with the advantages of plasticity and adaptations neural therapy, enables patients to movements and postures to which he would not have access due to their neurological condition²⁵, and among these therapeutic modalities is the rehabilitation with BWS³.

The child with a disability, to supply or its neuromotor deficits, is submitted to several rehabilitation treatments. However, often because it is a picture with no apparent improvement this treatment is neglected, what is perceived is that, when receiving these patients with prognosis unfavorable to running,

the necessary protocols related to rehabilitation of locomotion. There may be different reasons for this may occur: a possible lack of preparation of the professionals who receive these patients more serious, the lack of knowledge or lack of clinical evidence of potential benefits non-ambulatory of a walking training, or perhaps the lack of clinical indication and the difficulty to perform gait training with these patients due to the low number of professionals or lack of equipment.

This, we evaluated that SPC on a treadmill presents itself as a tool of rehabilitation which can assist in the development of the neuromotor of pediatric patients. Evolving with favorable prognoses for motor function thick and flexible.

For future studies that seek to verify the efficacy of SPC in the treatment of non-ambulatory children, the use of homogeneous samples and comparisons with control groups or other therapies.

Conclusion

Treatment with SPC on treadmill may enhance the functional performance of non-wandering children, making it possible to evolution of gross motor function, especially in the functions to lie down / roll and sit in addition to providing increased flexibility. Thus, a greater functional independence of these children in activities of daily living and better quality of life.

The therapy is pleasurable and favors the autonomy of individuals, benefits from early, intensive and in the context of the task, provides feedback about the child's performance and can lead to a secondary context, that is, to provide through training, greater autonomy motor.

Authors' contributions

Reitz GS: participation in the conception, design, search and statistical analysis of research data, collection of research data, interpretation of results, writing of the scientific article. Oliveira DF: participation in the conception, design, search and statistical analysis of research data, collection of research data, interpretation of results, writing

of scientific articles. Crippa PVS: participated in the data collection of the research, interpretation of the data, writing of the scientific article. Roesler H: participant in the design, design, statistical analysis of research data, interpretation of results.

Competing interests

No financial, legal or political competing interests with third parties (government, commercial, private foundation, etc.) were disclosed for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc.).

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