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ARAŞTIRMA / RESEARCH

Effectiveness of Bobath therapy on balance in cerebral palsy

Bobath terapisinin serebral palside denge üzerindeki etkisi

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Abstract

Purpose: Weakness on balance control is one of the most common problems for children with cerebral palsy. Present study aimed to investigate the effectiveness of 8 week-Bobath therapy on balance in children with diparetic or hemiparetic cerebral palsy.

Materials and Methods: A total of 15 cerebral palsy diagnosed children (8 diparesis, 7 hemiparesis) aged 5-14 years, were included in this study. Children could walk independently or by using a walking aid. The demographic data were saved for each case. Gross Motor Function Classification System and Gross Motor Function Measure were used to determine level of motor function. 1 Minute Walking Test, 10-meter Walking Test, Pediatric Balance Scale for balance ability and Functional Independence Measure for children (WeeFIM) for assessing of independence in activities of daily living were used. Bobath therapy were applied to children one 60-minute session, 2 days a week and 8 weeks in total. All evaluations were performed before treatment and repeated after treatment program.

Results: After 8-week Bobath therapy, the results showed that improvement in motor function, level of functional independence and balance scores were statistically significant.

Conclusion: Bobath therapy improves functional motor ability, independence level on daily living activities, and also balance ability in children with cerebral palsy.

Key words: Balance, bobath therapy, cerebral palsy.

Öz

Amaç: Serebral palsili çocuklarda en sık karşılaşılan sorunlardan biri, denge kontrolündeki zayıflıktır. Bu çalışmada, diparetik veya hemiparetik serebral palsili çocuklarda 8 haftalık Bobath terapisinin denge üzerine etkisini araştırmayı amaçladık.

Gereç ve Yöntem: Çalışmaya 5-14 yaşlarında toplam 15 serebral palsi tanılı (8 diparezi, 7 hemiparezi) çocuk dahil edildi. Çocuklar bağımsız olarak veya yürüme yardımcısıyla yürümektedir. Demografik veriler kaydedildi. Motor fonksiyon seviyesini belirlemek için Kaba Motor Fonksiyon Sınıflandırma Sistemi ve Kaba Motor Fonksiyon Ölçümü kullanıldı. Denge yeteneği için 1 Dakika Yürüme Testi, 10 metre yürüme testi ve Pediatrik Denge Ölçeği ve günlük yaşam aktivitelerindeki bağımsızlığı değerlendirmek için Çocuklar için Fonksiyonel Bağımsızlık Ölçeği (WeeFIM) kullanıldı. Bobath therapisi toplam 8 hafta boyunca, haftada 2 gün ve bir seansı 60 dakika olacak şekilde uygulandı. Tüm değerlendirmeler tedavi öncesi ve tedaviden sonra yapıldı.

Bulgular: 8 haftalık Bobath terapisinden sonra, motor fonksiyonlarda, fonksiyonel bağımsızlık düzeyi ve denge skorlarında istatistiksel olarak anlamlı iyileşmeler olduğu gösterildi.

Sonuç: Serebral palsili çocuklarda Bobath terapisi fonksiyonel motor yeteneği, günlük yaşam aktivitelerinde bağımsızlık düzeyi ve denge yeteneğini geliştirir.

Anahtar kelimeler: Bobath terapisi, denge, serebral palsi.

INTRODUCTION

The lesions in the central nervous system that occur in children with Cerebral Palsy(CP), prevent the proper functioning of the normal postural control mechanism[1]. This case is manifested as the tone changes in children with CP, lack of fixation, reciprocal innervation failure and abnormal coordination patterns. Poor postural control has been suggested to underlie the delays and deviations in motor skill acquisition and development observed in children with CP[2-4]. Balance control is important for competence in the performance of most functional skills, helping a child to recover from

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unexpected balance disturbances, either due to slips and trips or to self-induced instability when making a movement that brings them toward the edge of their limit of stability.

Physical therapy plays a central role in managing the condition; it focuses on function, movement, and optimal use of the child's potential. Physical therapists(PTs) use physical approaches to promote, maintain and restore physical, psychological and social well-being. PTs also teach parents how to handle their child at home for feeding, bathing, dressing and other activities, and give advice on mobility devices[5,6].

One of most widely used therapy approach for children with CP is Bobath therapy[7]. The Bobath concept emphasizes observation and analysis of the patient's current functional skill performance[8] and the identification of clear therapy goals. The aims of treatment are to influence muscle tone and improve postural alignment by specific handling techniques, and then to work for better active participation and practice of specific, relevant, functional skills[9,10]. Bobath therapy is considered to be appropriate for treating any motor control disorder within the CP spectrum[11].Treatment programmes within the Bobath concept are goal focused[10]. The Bobath approach centres on the likely potential for secondary deformities and how these may be prevented. Parent/caregiver education is one of the main elements of the intervention which is intended to facilitate the parent-child relationship, enable the parent to handle/assist with their child's difficulties, and give an intensive period for practice of activities[11,12]. Despite the widespread use of Bobath therapy there has been a lack of rigorous research into its clinical effectiveness[13]. The purpose of this study was to investigate the effects of 8-week Bobath therapy on balance and contribute to development of appropriate treatment for children with CP.

MATERIAL AND METHODS

This study was performed at Pamukkale University, School of Physical Therapy and Rehabilitation at the Department of Pediatric Rehabilitation between December 2014 and December 2015. The study was approved by the Ethical Board Committee of Pamukkale University Medical Faculty (Ref No: 15, Date: 25.11.2014) and completed in accordance with the principles of the Helsinki Declaration. A written informed consent from all parents was taken.

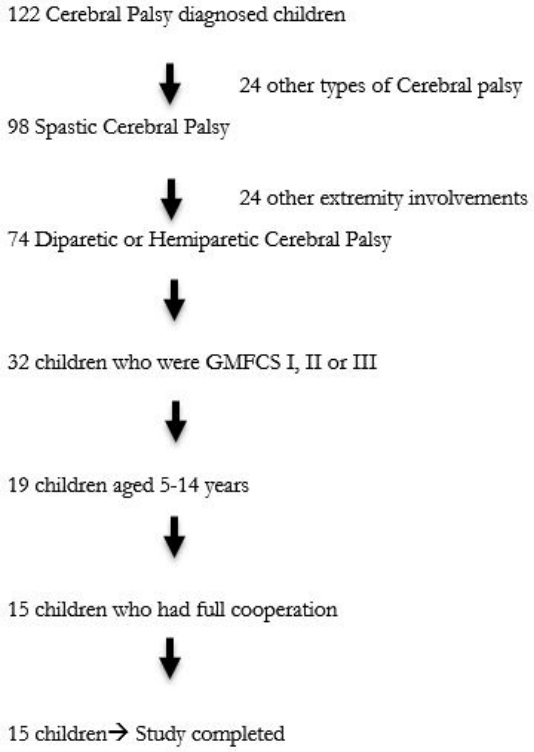

Figure 1. Flow diagram of study

Our study was completed with participation of a total of 15 eligible hemiparetic or diparetic children with CP, aged 5-14 years, according to the inclusion and exclusion criteria. Flow diagram of study is given in Figure 1. Inclusion criteria were ability to walk independently or by using assistive devices (at Level III or below on the Gross Motor Function Classification Systems-GMFCS), and have no cognitive impairments. Exclusion criteria were vision and hearing problems, can not be completed designated tests and failure to comply with study plan

Measures

Demographical information such as age, sex of patients and clinical information such as clinical type of CP, effected extremity, using walking aids were recorded.

The GMFM assesses gross motor abilities of children with CP in five dimensions: (A) Lie and Roll, (B) Sit, (C) Crawl and Kneel, (D) Stand, and (E) Walk, Run, and Jump. In children with CP, the

GMFM has been shown to be sensitive to change during periods of therapy. Individual dimension and total percentage scores can be calculated representing how many and to what extent items are achieved[14]. The GMFCS classifies children with CP into five levels according to motor ability with particular reference to sitting ability and independent mobility. Level I-Walks without restrictions, limitations in more advanced gross motor skills. Level II-Walks without restrictions, limitations walking outdoors and in the community. Level III-Walks with assistive mobility devices, limitations walking outdoors and in community. Level IV-Self mobility with limitations, children are transported or use power mobility outdoors and in the community. Level V-Self mobility is severely limited, even with use of assistive technology[15].

Balance of participants was assessed using 10-meter walking test(10MWT), 1-minute walk test(1minWT) and Pediatric Balance Scale(PBS). WeeFIM scale is also used to determine the level of independence of the participants' daily lives.

The **10MWT** is an effective way used to assess walking speed. It can be employed to determine functional mobility, gait and vestibular function.

The **1minWT** is a validated and user-friendly tool to evaluate walking ability and endurance in individuals with CP. McDowell et al. reported typical walking distances for the 1MWT and found the instrument to be significantly correlated to the Gross Motor Function Measure[16].

Pediatric Balance Scale: Functional balance was assessed using the PBS, which consists of 14 tasks similar to activities of daily living. The items are scored on a five-point scale (0, 1, 2, 3 or 4), with zero denoting an inability to perform the activity without assistance and four denoting the ability to perform the task with complete independence. The maximum score is 56 points. The test is performed with the child clothed and making use of his/her habitual brace and/or gait-assistance device[17,18].

WeeFIM is useful in assessing functional independence for children with developmental disabilities aged 6 months to 21 years. WeeFIM is an 18-item, 7-level ordinal scale instrument that measures a child's consistent performance in essential daily functional skills. Three main domains (self-care, mobility, and cognition) are assessed by interviewing or by observing a child's performance of a task to criterion standards[19].

Bobath therapy program

After the patient assessment, individualized Bobath therapy program were set. Bobath therapy was applied 2 days in a week for a total of 8 weeks. One therapy session lasted 60 minutes. The program included the following: activities for regulating tone, work that supports sense-perception-motor development, activities that facilitate regular movement, balance and functional ability.

The following exercises were made to achieve these goals:

- Vestibular and proprioceptive training on balance board and exercise balls in different sizes, dynamic balance training and proximal stabilization in sitting, kneeling and standing position (eyes open and closed),
- Balance exercises in front of the mirror, standing on one foot for improving the proprioceptive input (eyes open and closed), Balance training on the trampoline,
- Weight bearing exercises in sitting, crawling, kneeling and standing position for equal weight transfer on both lower extremities without disturbing the postural control,
- Functional reaching and ball throwing-keeping exercises in various directions,
- Stepping exercises in different directions and on different grounds.

Statistical analysis

As a result of power analysis, it was calculated that 90% power would be obtained in with 95% confidence level when 15 children were included in the study. The data was analyzed by using SPSS software (version 18) for Windows. The Kolmogorov-Smirnov test was used to test normality of distribution. The arithmetic mean and standard deviation were used for descriptive data. Paired sample t-test was applied, as scores were normally distributed. Wilcoxon Signed-Rank Test was used as scores were not normally distributed. A level of $p<0.05$ was considered significant.

RESULTS

CP diagnosed 15 patients (7 girls, 8 boys) with hemiplegia and diplegia, aged 5-14 years, independent or using assistive devices to walk (GMFCS I, II or III) were included in the study. All patients completed the study program. Demographic data of the patients are shown in Table 1. Cognitive level of children with CP was able to understand all the commands and cooperations were full.Changes in balance and functional independence levels of children with CP were statistically significant ($p<0.01$) Table 2. Statistical data showing children's gross motor function before and after treatment are given in Table 3.

Table 1. Demographic characteristics of children with Cerebral Palsy

Variables	Min-Max	X±SD
Age (months)	72-168	120.4±31.69
Height (cm)	105-170	133±18.87
Weight (kg)	17-65	30.8±12.82
Body Mass Index(kg/m^2)	10.88-22.49	16.75±2.99

Table 2. Results of Gross Motor Function Classification (GMFCS) before and after therapy

Variables	GMFCS- BT	GMFCS- AT
	n(%)	n(%)
Level I	3(20)	10(66.7)
Level II	8(53.3)	4(26.7)
Level III	4(26.7)	1(6.7)

BT: Before Therapy, **AT:** After Therapy, **GMFCS:** Gross Motor Function Classification

Table 3. Comparison of level of functional independence and balance before and after therapy

	BT		AT		
Variables	**Min-Max**	**X±SD**	**Min-Max**	**X±SD**	**p**
1-mWT (m)	5-70	43.86±19.89	16-76	55.06±19.13	0.0001*a*
10MWT (sec)	9-127	22.73±29.65	7-35	12.26±7.41	0.001*b*
PBS	22-56	47.2±9.65	38-56	52.33±5.20	0.001*a*
WeeFIM	85-126	112.1±13.34	96-126	118.3±9.03	0.001*a*

BT: Before Therapy, **AT:** After Therapy, **1-mWT:** 1 minute walk test, **10MWT:** 10 meter walking test, **PBS:** Pediatric Balance Scale, **WeeFIM:** Functional Independence Measure for children; ***a*:** Paired Sample t Test, ***b*:** Wilcoxon Signed Ranks Test

Table 4. Comparison of level of gross motor function before and after therapy

Level of Gross Motor Function	BT		AT		
	Min-Max	**X±SD**	**Min-Max**	**X±SD**	**p***
GMFM-D	62-100	83.8±13.25	79-100	94.26±6.76	0.0001
GMFM-E	54-100	79.93±17.28	69-100	88.6±12.25	0.0001
GMFM (Total Score)	81-100	92.2±6.21	90-100	96.53±3.68	0.0001

BT: Before Therapy, **AT:** After Therapy, **GMFM:** Gross Motor Function Measure
*Paired Samples t Test

Table 5. Correlation between level of gross motor function and balance measures after therapy

	r/p	1minWT	10MWT	PBS	WeeFIM
GMFM (Total Score)	r	0.822**	-0.757**	0.848**	0.726**
	p	0.0001**	0.001**	0.0001**	0.002**
GMFM-D	r	0.652**	-0.654*	0.580*	0.475
	p	0.008**	0.008**	0.023*	0.073
GMFM-E	r	0.815**	-0.761**	0.910**	0.749**
	p	0.0001**	0.001**	0.0001**	0.001**

***:p**≤0,05 ****:p**<0,01 **r:** Spearman Correlation coefficient
1-mWT:1-minute walk test, **10MWT:** 10-meter walking test, **PBS:** Pediatric Balance Scale, **WeeFIM:** Functional Independence Measure for children, **GMFM:** Gross Motor Function Measure

Table 6. Correlation between level of functional independence and balance measures after therapy

	1minWT		10MWT		PBS	
	p*	r	p	r	p*	r
WeeFIM	0.007	0.66	0.056	-0.503	0.0001	0.805

***p**<0,05 **r:** Spearman Correlation coefficient
1-mWT: 1-minute walk test, **10MWT:** 10-meter walking test**, PBS:** Pediatric Balance Scale, **WeeFIM:** Functional Independence Measure for children

Changes in GMFM-D (standing) section, GMFM-E (walking) section and GMFM total score were statistically significant ($p<0.01$). Table 4. Corrrelation between level of gross motor function and balance abilitiy after therapy are given in Table 5. There is a significant positive correlation between level of functional independence and balance abilitiy after therapy are given in Table 6.

DISCUSSION

In this study, a significant improvement in balance, gross motor function and functional independence levels was seen over the 8-week Bobath therapy period, compared with the pre and post-treatment scores. This effect might be anticipated as the Bobath concept focuses on gaining new functional skills. It is also concerned with how a child performs movement, as this has implications for the efficiency of the movement and prevention of secondary deformities, which in turn affects the potential for achieving more functional skills in the future[10].

Balance is necessary to explore and interact with the environment, and has been described as an anchor for purposeful movement and functional activities in CP. The children with CP have several basic limitations on static and dynamic postural control tasks such as sitting, standing, and walking[19]. In this study, post-treatment mean scores of 1MWT and 10MWT changed positively compared pre-treatment mean scores. In that case, Bobath Therapy improved gait and balance skills of CPC. In their systematic review, Butler and Darrah examined the effect of Bobath therapy on CP, with evidence-based research and found evidence that the Bobath therapy developed postural control and balance[21].

Bobath therapy is the most widely adopted physiotherapy approach in children with CP. The aims of treatment are to influence muscle tone and improve postural alignment by specific handling techniques, and then to work for better active participation and practice of specific, relevant, functional skills1. Our study showed statistically significant improvements were found in level of gross motor function after 8-week Bobath approach. Similar to our results, eight hours (two 40min sessions/wk for 6wks) of Bobath therapy focusing on trunk control improved postural control in sitting in children with spastic diplegia (GMFCS II–V), aged 3 to 10 years22. Bobath therapy for 72 hours (three 120 min sessions/wk for 12wks) improved limits of stability and standing balance, and reduced fall risk, in children with spastic diplegic CP(GMFCS I–II)[23].

According to a study, Bobath therapy was applied to 50 children with spastic CP, between the ages of 1-7, and gross motor skills of patients were evaluated with GMFM. They found statistically significant improvement in gross motor skills of patients after 8-month treatment[24]. In our study, because children with CP, who were able to walk using an assistive device at least, were included, all of them had full points for GMFM-A, GMFM-B and GMFM-C. Average scores of GMFM-D, GMFM-E and total GMFM, which were essential important for our work, increased significantly. This indicates that Bobath approach develops on gross motor function in early stages of children with CP and it was statistically significant correlated GMFM total score and Pediatric Balance Scale; therefore balance improves.

On the other hand, in literature the studies showing that Bobath does not improve GMFM points are also available, unlike the results of our study. Bower and McLellan[25] applied Bobath therapy to 30 children with spastic CP between 18 mths-8 yrs for 6 months by divided two groups (treatment and control group). No statistically significant difference was observed in gross motor skills[25].

Harbourne et al.[26] divided a group children to two groups(treatment and control). Bobath therapy were applied to one part of treatment group, the other part of it was given home exercise program. Control group had no exercise. GMFM and the results obtained from the balance measures were better in Bobath group[26]. The relationship between the level

of functional independence and balance measures show that children with CP achieving better balance are more independent in their's daily activities. Thus, additional therapies improving balance are should be applied to improve the functional independence of children[27].

Balance abilities along with an increase in the level of functional independence and level of functional motor increased thanks to 8-week Bobath therapy. Increasing in gross motor level of children with CP affected on balance, positively. Better balance and postural control enable children to walk more convenient and fast, use limbs better, in this case helps to be more successful and more independent in their children's daily activities. Limitations of this study were there was no control group to compare the result of treatments and evaluator was not double blind to the study.

Bobath therapy is an effective treatment to improve balance and postural control skills, functional independence in activities of daily living and motor development levels in children with CP. There are not enough evidence-based studies in this field in literature. It should be focused more on development of mission-critical balance skills for children with CP, especially in our country by increasing the number of randomized controlled studies in this area.

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