

Hemifacial Spasm: Results of Treatment with Low Dose Botulinum Toxin Injection

Areerat Suputtitada MD*, Kammant Phanthumchinda MD**,
Chaichon Lochareernkul MD**, Nijasri C Suwanwela MD**

* Department of Rehabilitation Medicine, Faculty of Medicine, Chulalongkorn University

** Department of Medicine, Faculty of Medicine, Chulalongkorn University

Background : Hemifacial Spasm (HFS) is a common movement disorder in Thailand. Botulinum toxin type A (BTA) is an effective and safe treatment for this condition. The success of BTA treatment depends on the experience of the clinician.

Objective : To study the demographic data, efficacy and safety of low dose BTA injection in HFS patients.

Setting : The Spastic and Dystonia Clinic, Department of Rehabilitation Medicine, King Chulalongkorn Memorial Hospital.

Design : Open-label, prospective case-series study.

Patients : All patients with HFS referred for BTA injection from December 1st, 1995 to November 30th, 2003.

Method : Sex, age, side of spasm, onset of symptoms before BTA injection, underlying diseases, sites of BTA injection, dose of each BTA treatment, duration of response, efficacy, and side-effects were analyzed. 3-5 units of BOTOX were intramuscularly injected per site to all muscles that had spasm. After injection, a 20-minute cold compression on the first day was followed by 20-minute warm compression with massage at each injection site per day for 14 days.

Results : A total of 112 patients with HFS were treated with 874 BTA treatments. There were 71 females (63.4%) and 41 males (36.6%). The mean age was 45 years. 75 patients (67%) were affected on the left side. Mean duration of symptoms was 3.4 years. The sites of injection were orbicularis oculi and orbicularis oris muscles in all 874 treatments (100%). The mean dose of all treatments was 25 units. The mean initial dose was 30.5 units. The mean dose for subsequent injection was 23 units. The mean duration between treatments was 4.7 months. The mean initial duration was 3.5 months. The mean duration for subsequent injection was 4.8 months. The outcomes of treatment assessed at 4 weeks after injection classified as excellent (> 80% improvement) were found in 845 treatments (96.7%). Most treatments had no complication (91.9%). Ptosis, facial paresis and double vision were mild and transient, lasting 1-4 weeks. There were no long-term complications of BTA treatment in the present series.

Conclusion : Low dose BTA injection is an effective treatment for hemifacial spasm patients. There was a longer duration of response in subsequent injections and a lower complication rate in the present study when compared to others.

Keywords : Botulinum toxin, Hemifacial spasm

J Med Assoc Thai 2004; 87(10): 1205-11

e-Journal: <http://www.medassoc.thai.org/journal>

Hemifacial spasm (HFS) is clinically marked by involuntary unilateral contraction of the muscular system innervated by the facial nerve⁽¹⁾. Its clinical picture may vary substantially. Some patients may merely present with contractions of the orbicularis

oculi muscle; in other patients, however, the entire musculature innervated by the facial nerve including platysma may be involved. Mild progression of the symptom is seen in many cases⁽¹⁾. HFS is often triggered by fatigue, anxiety, stress, reading and driving; it may persist during sleep^(2,3). Rarely, HFS can be bilateral or familial⁽²⁾. HFS causes embarrassment and an inferiority complex to the patient. In general, HFS

Correspondence to : Suputtitada A, Department of Rehabilitation Medicine, Faculty of Medicine, Chulalongkorn University, Bangkok 10330, Thailand.

is caused by mechanical compression by redundant vessel and distortion of the root exit zone of the facial nerve by an aneurysm which are regarded as idiopathic^(2,3). Lipoma, epidermoid tumor, arterio-venous malformation have been found in less than 1% of the cases^(2,3). Vessel-nerve contact results in mild facial paralysis and may be demonstrated by MRI. Conventional treatment with carbamazepine is only occasionally effective, and the side effect is unacceptable to many patients⁽⁴⁾. The surgical treatment is vascular decompression of the facial nerve, which usually gives excellent results (84%)⁽⁵⁾. However, complications are serious, i.e. facial weakness (4.2%), transient facial weakness (3.2%), permanent hearing loss (3.2%), brain stem infarct (0.3%), cerebellar hematoma (0.5%), CSF leak (2.4%) and operative death (0.1%)⁽⁵⁾.

Since 1990, many studies have shown that local injection of botulinum toxin is effective for HFS. Different evaluation criteria had been employed in these studies, making comparison difficult. In summary, good to excellent improvements were reported in 76% to 100%⁽⁶⁻⁸⁾ of these patients. The mean duration of action of each injection ranged between 2.6 and 4^(9,10) months. The most common side effects were dry eye 7% to 18.1%^(11,12) ptosis 2.8% to 23.3%^(12,13) facial weakness 17.6% to 97%^(13,14) tearing 5.5%⁽¹²⁾ and diplopia less than 1% to 6%^(11,15). All of these undesired effects were transitory, untoward systemic effects were not quoted in any study. The conclusion is that botulinum toxin injections are safe and highly effective treatment of HFS⁽¹⁾.

The authors present here the long-term results of efficacy and safety of low dose botulinum toxin A (BTA) injection in HFS patients over an 8-year period.

Objective

The objective was to study the demographic data as well as efficacy and safety of low dose BTA injection in HFS patients.

Study design

Open-label, prospective case-series study.

Patients and Method

All patients with HFS referred for BTA injection at the Spastic and Dystonia Clinic, Department of Rehabilitation Medicine, King Chulalongkorn Memorial Hospital, Bangkok, Thailand from December 1st 1995 to November 30th, 2003 were analyzed. Demographic data such as sex, age, side of hemifacial spasm, onset

of symptoms before BTA injection, underlying diseases (hypertension, diabetes mellitus, heart disease, stroke), history of Bell's palsy, history of head trauma, history of tinnitus, previous surgery (micro vascular decompression of the facial nerve), sites of BTA injection, dose of each BTA treatment, duration of response, efficacy, immediate side-effects, long-term side effects and spontaneous remission (no need for injection over two years) were reported. Data analysis were presented as number (n) and percentage of patients, mean $\pm$ standard deviation ($\bar{x} \pm SD$) and range.

Study drug

Botulinum toxin type A (BOTOX[®], 100 unit per vial, Allergan, INC) was reconstituted for injection to yield 50 unit/ml by 0.9% sterile unpreserved saline solution by the first author.

Injection technique and care after injection

With the patient in a lying position, the injection sites (as shown in Fig. 1) were chosen by clinical assessment of spasm. The injection sites were cleaned with 70% alcohol and BOTOX was injected intramuscularly 3-5 unit each site. A thirty gauge-needle attached to a tuberculin syringe was used for injection. After injection, 20-minute cold compression on the first day and then 20- minute warm compression with massage at the injection sites for 14 days.

Assessment and follow-up

The outcomes of the treatment were assessed by the investigators at 4 weeks after injection. They were classified as excellent (> 80% improvement), good (60-80% improvement), fair (20-60% improvement), poor (1-20% improvement) and no improvement. In

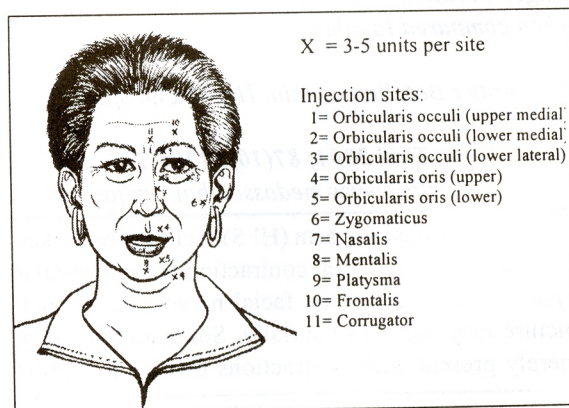


Fig. 1 Demonstration of injection sites and botulinum toxin usage

addition, complications were assessed by the investigators. Generally, appointment was made every three months for each treatment, but the frequency of their visits were adjusted to accommodate individual needs.

Results

A total of 112 patients with HFS were treated with 874 BTA treatments during a period of 8 years. The demographic data of all patients are shown in Table 1.

There were 71 females (63.4%) and 41 males (36.6%). The mean age of all patients was 45 ± 11.1 years (range 24-67 years). Of the 112 HFS patients, 75 (67%) were affected on the left side. Their mean duration of symptoms before treatment was 3.4 ± 3.1 years (range 1-12 years). The mean follow-up period was 3.5 ± 2.5 years (range 1-8 years). Several patients had underlying diseases: hypertension in 12 patients (10.71%), diabetes mellitus in 8 patients (7.1%), heart disease in 8 patients (7.1%), and stroke in 2 patients (1.8%). History of Bell's palsy in 1 patient (0.9%), tinnitus in 5 patients (4.5%), and history of microvascular decompression of the facial nerve in 1 patient (0.9%) were recorded.

The sites of injection were mostly orbicularis oculi muscle in 874 treatments (100%), orbicularis oris muscle in 874 treatments (100%), zygomaticus muscle in 468 treatments (53.5%), nasalis in 136 treatments (15.6%), mentalis in 168 treatments (19.2%), platysma in 46 treatments (5.3%), frontalis in 42 treatments (4.8%), and corrugator in 34 treatments (3.9%) as shown in Table 2.

The mean dose of BOTOX® of all treatments was 25 ± 0.6 units (range 10-45 units) per injection. There was decrement in the mean dose for each subsequent injection. The mean initial dose was 30.5 ± 0.4 units (range 20-45 units), the second 29.5 units, the third 29 units, the fourth 28.5 units, the fifth 28 units, the sixth 28 units, the seventh 28 units, the eight 27 units, the ninth 26 units, and the tenth 25 units. The mean dose of subsequent injection was 27.5 ± 0.5 units (range 10-35 units) as shown in Table 3 and Fig. 2.

The mean duration of response of all treatments was 4.1 ± 0.4 months (range 3-6 months). The durations also increased each subsequent injection. The mean initial durations was 3.5 ± 0.4 months (range 3-5 months), the second 3.8 months, the third 4.0 months, the fourth 4.1 months, the fifth 4.3 months, the sixth 4.3 months, the seventh 4.4 months, the eight 4.5 months, the ninth 4.6 months, and the tenth 4.8 months. The mean duration of subsequent injection

Table 1. Demographic data of the all treatments

Sex:	Male	41 patients	36.6%
	Female	71 patients	63.4%
Age (yrs)		45 (SD 11.1)	
		range 24-72	
Side of HFS	Right	37 patients	33.0%
	Left	75 patients	67.0%
Duration of symptoms before treatment (yrs)		3.4 (SD 3.1)	
		range 1-12	
Follow up period (yrs)		3.45 (SD 2.45)	
		range 1-8	
Associated conditions			
History of Bell's palsy		1 patient	0.9%
History of tinnitus		5 patients	4.5%
History of Microvascular decompression		1 patient	0.9%
Underlying diseases			
Hypertension		12 patients	10.7%
Diabetes mellitus		8 patients	7.1%
Heart disease		8 patients	7.1%
Stroke		2 patients	1.8%

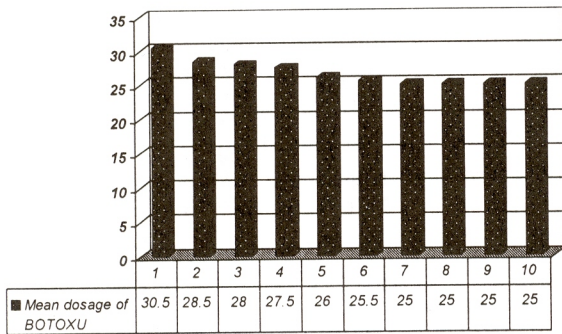
Table 2. The sites of BOTOX^a injection in 874 treatments

Muscles	No. of Treatments
Orbicularis oculi	874 (100%)
Orbicularis oris	874 (100%)
Zygomaticus	468 (53.5%)
Nasalis	168 (19.2%)
Mentalis	136 (15.6%)
Platysma	46 (5.3%)
Frontalis	42 (4.8%)
Corrugator	34 (3.9%)

Table 3. Dose of BOTOX® and duration of response

	n	Mean	range
Dose of BOTOX® of all treatment (units)	874	25.0 (SD0.6)	10-45
Initial dose of BOTOX® (units)	112	30.5 (SD0.4)	20-45
Dose of subsequent injection (units)	762	25.5 (SD0.5)	10-35
Duration of response of all treatment (months)	874	4.7 (SD0.4)	3-6
Initial duration (months)	112	3.5 (SD0.4)	3-5
Duration of subsequent injection (months)	762	4.8 (SD0.4)	3-6

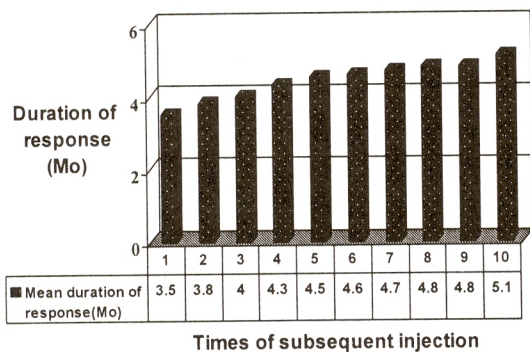
was 4.8 ± 0.4 months (ranged 3-6 months) as shown in Table 3 and Fig. 3. There were 5 patients (8.9%) with spontaneous remission (i.e. injection free interval lasting more than two years).



N1=112 patients; N2=105 patients; N3 = 102 patients; N4=99 patients; N5= 98 patients; N6= 95 patients; N7=86 patients; N8= 75 patients; N9= 58 patients; N10= 44 patients

There was continuously decrement in mean dosage of BOTOX® in subsequent injection

Fig. 2 Mean dosage of BOTOX® in each subsequent injection



N1=112 patients; N2=105 patients; N3 = 102 patients; N4=99 patients; N5= 98 patients; N6= 95 patients; N7=86 patients; N8= 75 patients; N9= 58 patients; N10= 44 patients

There was increment in mean duration of response of BOTOX® in subsequent injection

Fig. 3 Mean duration of BOTOX® in each subsequent injection

Table 4. Outcomes of treatments

Outcomes	No of Treatments
Excellent (> 80%)	845 (96.7%)
Good (60-80%)	25 (2.9%)
Fair (20-60%)	3 (0.3%)
Poor (1-20%)	1 (0.1%)
No improvment	0 (0%)

Table 5. Immediate side-effects of Botox injection

Side-effects	No of Treatments
No complication	803(91.9%)
Mild ptosis	25(2.9%)
Mild facial paresis	26(3%)
Double vision	15(1.7%)
Excessive lacrimation	5(0.6%)

There was no long-term complication of botulinum toxin treatment in the present series.

Discussion

HFS usually appears between the fourth and fifth decade of life⁽¹⁶⁾, as found in the present series (i.e. mean age of the onset was 45 yrs). The spasm most notably involves the orbicularis oculi, orbicularis oris, zygomaticus, frontalis and mentalis muscles on one side of the face⁽¹⁶⁾, as in the present series. As the condition progresses, twitching becomes more obvious on involuntary movement all ipsilateral facial as well as the superficial muscles of the neck. Occasionally, the involvement of the stapedius muscle of the middle ear may cause the patients to have auditory symptom characterized by a "thumping" or "clicking" noise associated with the spasm. Occasionally, the patient may complain of tinnitus and hearing loss. In our series, although injection at stapedius muscle was not possible, the authors found that tinnitus and clicking in the ear disappeared when injected BTA at zygomaticus.

The response rate of the patients is compared to other series in Table 6^(9,11,17-21). The presented data showed 98% improvement that is also comparable to the other series. The difference between the duration of improvement and the dose are attributed to different types of botulinum toxin (BOTOX vs Dysport), differences in injection sites and techniques, difference in dose per injection site.

The mean dose of all treatments was 25 units, similar to that of Pongvarin et al⁽¹⁹⁾ but lower than

The outcomes of treatment assessed at 4 weeks after injection were classified as: excellent (> 80% improvement) in 845 treatments (96.7%), good (60-80% improvement) in 25 treatments (2.9%), fair (20-60% improvement) in 3 treatments (0.3%), poor (1-20% improvement) in 1 treatment (0.1%) and no case without improvement, as shown in Table 4.

There was no complication in most treatments (91.9%). The immediate complications were ptosis (2.9%), mild facial paresis (3%), double vision (1.7%), lacrimation (0.6%) and as shown in Table 5. These complications were transient, lasting only 2-4 weeks.

Table 6. Long-term results in reported series of botulinum toxin treatment

Type of BTA	Authors	Follow up (Yrs)	Pts (n)	No of Treatments	Mean dose (Units)	Response rate (%)	Duration of response (Months)	Side effect (%)
BOTOX	Dutton, et al. ⁽¹¹⁾	4	60	148	-	96.8	3.6	23
	Taylor, et al. ⁽¹⁷⁾	-	130	336	-	98	4.23	32
	Flanders, et al. ⁽¹⁸⁾	8	65	-	34	100	4.06	8
	Poungvarin, et al. ⁽¹⁹⁾	10	875	3,061	25	98	4.06	24.4
	Suputtitada, et al.	8	112	874	25	98	4.68	8.13
Dysport	Elston ⁽²⁰⁾	7	73	-	120-160	75	2.8-3.5	19-33
	Bergh, et al. ⁽²¹⁾	5	40	144	53	100	4.93	22
	Jitpimolmard, et al. ⁽⁹⁾	7	175	883	92	97	3.4	29

that of Flanders et al⁽¹⁸⁾. At the authors' center, low-dose regimen for every condition treated with BTA is always used⁽²²⁻²⁷⁾. The possible explanations were: 1) the smaller muscle mass of Thai patients; and 2) the tropical climate in Thailand may facilitate extensibility of the spastic muscle.

The mean dose in the initial treatment in the present study (30.5 units) was higher than that of subsequent treatments (25 units). The mean duration of the initial treatment (3.5 months) was shorter than that of subsequent treatments (4.8 months). These implied that the severity of the symptoms seem to be lessened with the subsequent treatments. Possible explanation may be that: 1) there were adaptation of receptors of the spastic muscles, 2) there was BTA accumulation at the neuromuscular junction, and 3) there was no clinical resistance over long-term subsequent injection. There was longer duration of response in the present study when compared to others^(9,11,17-21).

Also, there was a lower complication rate in the present study when compared to others^(9,11,17-21). These may be due to: 1) lower dose of BTA used per site, 2) different sites of injection were chosen, 3) the cold and hot compression with massage which may cause better diffusion of the toxin after injection.

Conclusion

Low dose BTA injection is an effective treatment for hemifacial spasm. There was a longer duration of response in subsequent injections and a lower complication rate in the present study when compared to others.

References

1. Jost W H, Kohl A. Botulinum toxin: evidence - based medicine criteria in blepharospasm and hemifacial spasm. *J Neurol* 2001; 248 (Suppl1): 1/21-1/24.

2. Elston J S. Idiopathic blepharospasm, hemifacial spasm and therapeutic ptosis induction. In: Moore P, ed. *Handbook of botulinum toxin treatment*. Cambridge: Blackwell Science, 1995: 90-100.

3. Jannetta PJ, Abbasy M, Maroon JC, Ramos FM, Albin MS. Etiology and definitive microsurgical treatment of hemifacial spasm. *J Neurosurg* 1977; 47:3 21-8.

4. Alexander GE, Moses H. Carbamazepine for hemifacial spasm. *Neurology* 1982; 32: 286-7.

5. Barker II FG, Jannetta PJ, Bissonette DJ, Shield PT, Larkins MV, Jho HD. Microvascular decompression for hemifacial spasm. *J Neurosurg* 1995; 82: 201-10.

6. Berardelli A, Formica A, Mercuri B, Abbruzzese G, Agnoli A, Agostino R, Caraceni T, Carella F, De Fazio G, De Grandis D, et al. Botulinum toxin treatment in treatments with focal dystonia and hemifacial spasm. A multicenter study of the Italian Movement disorder Group. *Ital J Neurol Sci* 1993; 14: 361-7.

7. Novis SA, De Mattos JP, De Rosso AL. Botulinum toxin in blepharospasm, in hemifacial spasm and in cervical dystonia: results in 33 treatments. *Arq Neuropsiquiatr* 1995; 553: 403-10.

8. Park YC, Lim JK, Lee DK, Yi SD. Botulinum a toxin treatment of hemifacial spasm and blepharospasm. *J Korean Med Sci* 1993; 8: 334-40.

9. Jitpimolmard S, Tiamkao S, Laopaiboon M. Long term results of botulinum toxin type A (Dysport) in the treatment of hemifacial spasm: a report of 175 cases. *J Neurol Neurosurg Psychiatry* 1998; 64: 751-7.

10. Astarloa R, Morales B, Sanchez V, Penafiel N, Rabano J, Olivan J, Garcia de Yebenes J. Focal dystonias and facial hemispasm: treatment with botulinum A toxin. *Arch Neurobiol* 1991; 54: 210-7.

11. Dutton JJ, Buckley EG. Longterm results and complications of botulinum A toxin in the treatment of blepharospasm. *Ophthalmology* 1988; 95: 1529-34.

12. Kraft SP, Lang AE. Botulinum toxin injections in the treatment of blepharospasm, hemifacial spasm and eyelid fasciculations. *Can J Neurol Sci* 1988; 15: 276-80.

13. Poungvarin N, Viriyavejakul A. Two hundred and fifty treatments with hemifacial spasm treated with botuli-

- num toxin injection. *J Med Assoc Thai* 1992; 75: 199-203.
14. Yoshimura DM, Aminoff MJ, Tami TA, Scott AB. Treatment of hemifacial spasm with botulinum toxin. *Muscle Nerve* 1992; 15: 1045-9.
15. Poewe W, Kleedorfer B. Treatment of essential blepharospasm and hemifacial spasm by local injections of botulinum toxin type A: experiences in 50 treatments. *Arch Neurol* 1989; 16: 78-82.
16. Boridic GE. Hemifacial spasm: Evaluation and management, with emphasis on botulinum toxin therapy. In: Jankovic J, Hallet M, eds. *Therapy with botulinum toxin*. New York: Marcel Dekker, 1994: 331-51.
17. Taylor JDN, Kraft SP, Kazdan MS, et al. Treatment of blepharospasm and hemifacial spasm with botulinum A toxin: a canadian multicenter study. *Can J Ophthalmol* 1991; 26: 133-8.
18. Flanders M, Chin D, Boghen D. Botulinum toxin preferred treatment for hemifacial spasm. *Eur Neurol* 1993; 33: 316-9.
19. Pongvarin N, Nilanont Y, Prayoonwiwat N, Senanarong V. Hemifacial spasm treated with botulinum toxin injection: A ten-year experience at Siriraj Hospital. *Siriraj Hosp Gaz* 2001; 53(1): 1-7.
20. Elston JS. The management of blepharospasm and hemifacial spasm. *J Neurol* 1992; 239: 5-8.
21. Vanden Bergh P, Francart J, Mourin S, et al. Five years experience in the treatment of focal movement disorders with low-dose Dysport botulinum toxin. *Muscle Nerve* 1995; 18: 720-29.
22. Suputtitada A. Managing spasticity in pediatric cerebral palsy using a very low dose of botulinum toxin type A: preliminary report. *Am J Phys Med Rehabil* 2000; 320-6.
23. Suputtitada A. Three case reports of using botulinum toxin type A in chronic myofascial pain syndromes. *J Thai Rehabil* 2001; 11(1): 35-41.
24. Suputtitada A. Cervical spondylosis and myelopathy in cervical dystonia. In: Peek WJ, Lankhorst CJ, eds. *Proceedings of the 1st World Congress of the International Society of Physical and Rehabilitation Medicine (1st ISPRM) at Amsterdam, Netherland, July 7-13, 2001*.
25. Suputtitada A. Local botulinum toxin type A injection in the treatment of spastic toes. *Am J Phys Med Rehabil* 2002; 81: 770-5.
26. Suputtitada A, Phanthumchinda K, Lochareernkul C, Suwanwela NC. Treatment of writer's cramp with very low dose botulinum toxin type A at King Chulalongkorn Memorial Hospital. *Proceedings of the International Conference 2002: Basic and Therapeutic Aspects of Botulinum and Tetanus Toxins at Hannover, Germany on June 8-11, 2002*. Abstract published in *N-S Arch Pharmacol* 2002; 148 Suppl 2: 365.
27. Suputtitada A. Effectiveness of low dose botulinum toxin in spastic adult patients. In: Ring H, Soroker N, eds. *Proceedings of the 2nd World Congress of the International Society of Physical and Rehabilitation Medicine (2nd ISPRM) at Prague, Czech Republic, May 18-22, 2003*.

ภาวะใบหน้าที่กระตุกครึ่งซีก: การรักษาด้วยการฉีดโบทูลินัมทอกซินขนาดน้อย

อารีรัตน์ สุพทุธธาดา, กัมมันต์ พันธุมจินดา, ชัยชน โลว์เจริญกุล, นิจศรี ชาญณรงค์ สุวรรณเวลา

ปัญหา : ภาวะใบหน้าที่กระตุกครึ่งซีกเป็นภาวะการเคลื่อนไหวผิดปกติที่พบบ่อยในประเทศไทย การฉีดโบทูลินัมทอกซินมีประสิทธิภาพและปลอดภัยในการรักษาภาวะนี้ ผลสำเร็จของการฉีดโบทูลินัมทอกซินขึ้นกับประสบการณ์ของแพทย์ผู้ทำการรักษา

วัตถุประสงค์: เพื่อศึกษาลักษณะทางคลินิกประสิทธิภาพและความปลอดภัยในการฉีดโบทูลินัมทอกซินขนาดน้อยในการรักษาภาวะใบหน้าที่กระตุกครึ่งซีก

สถานที่ที่ทำการศึกษา : คลินิกลดอาการเกร็งและบิดกระตุกของกล้ามเนื้อ ฝ่ายเวชศาสตร์ฟื้นฟู โรงพยาบาลจุฬาลงกรณ์

รูปแบบการศึกษา : แบบไปข้างหน้า ติดตามผลการรักษาระยะยาว โดยไม่มีกลุ่มควบคุม

ผู้ป่วยที่ได้ทำการศึกษา : ผู้ป่วยใบหน้าที่กระตุกครึ่งซีกทุกรายที่ส่งมาเพื่อรับการฉีดโบทูลินัมทอกซิน ระหว่าง 1 ธันวาคม 2538 และ 3 พฤศจิกายน 2543

วิธีการศึกษา : เก็บข้อมูลผู้ป่วยด้าน อายุ เพศ ข้างที่มีใบหน้าที่กระตุก ระยะเวลาของการมีอาการ โรคประจำตัว ตำแหน่งฉีดยา ขนาดยา และระยะเวลาการออกฤทธิ์ของโบทูลินัมทอกซิน ประสิทธิภาพ และฤทธิ์ข้างเคียง ฉีดยา BOTOX เข้าใต้ผิวหนัง 3-5 ยูนิต ต่อจุด ฉีดทุกจุดของกล้ามเนื้อที่กระตุก หลังฉีดประคบน้ำแข็ง 20 นาที ในวันแรก และน้ำอุ่น 20 นาที ในวันต่อมา ทุกวันจนครบ 14 วัน พร้อมกับวัดคลื่นตรงจุดที่ฉีดยาหลังประคบทุกวัน

ผลการศึกษา : ผู้ป่วยใบหน้าที่กระตุกครึ่งซีกทั้งหมด 112 ราย ได้รับการฉีดโบทูลินัมทอกซิน 874 ครั้ง เป็นหญิง 71 ราย (63.4%) ชาย 41 ราย (36.6%) อายุเฉลี่ย 45 ปี มีอาการกระตุกที่ใบหน้าซีกซ้าย 75 ราย (67%) ระยะเวลาเฉลี่ยตั้งแต่เริ่มมีอาการ 3.4 ปี ตำแหน่งฉีดยาส่วนใหญ่คือ กล้ามเนื้อ orbicularis occuli และ orbicularis oris ทั้งสองตำแหน่งตำแหน่งละ 874 ครั้ง (100%) ขนาดยาเฉลี่ยของการรักษาทั้งหมด 25 ยูนิต ขนาดยาเฉลี่ยของการรักษาครั้งแรก 30.5 ยูนิต ครั้งต่อมา 23 ยูนิต ระยะเวลาเฉลี่ยของการตอบสนองของยาของการรักษาทั้งหมด คือ 4.7 เดือน ระยะเวลาเฉลี่ยของการรักษาครั้งแรก คือ 3.5 เดือน ครั้งต่อมา คือ 4.8 เดือน ผลการรักษาเมื่อประเมิน 4 สัปดาห์หลังฉีดยาพบว่า ได้ผลดีมาก (ดีขึ้น >80%) ถึง 845 ครั้งของการรักษา (96.7%) การรักษาสส่วนใหญ่ไม่พบฤทธิ์ข้างเคียงอันไม่พึงประสงค์ (91.9%) ได้แก่ อาการหนังตาตก ใบหน้าอ่อนแรง หรือเห็นภาพซ้อน ที่พบจะไม่รุนแรง และอยู่ชั่วคราวเพียง 1-4 สัปดาห์ ไม่พบฤทธิ์ข้างเคียงใด ๆ ระยะยาว

สรุป : การฉีดโบทูลินัมทอกซินขนาดน้อยเป็นการรักษาภาวะใบหน้าที่กระตุกครึ่งซีกที่มีประสิทธิภาพ และพบว่าระยะเวลานาน ในการออกฤทธิ์ของยาเมื่อฉีดครั้งต่อมาจะยาวนานกว่า และฤทธิ์ข้างเคียงอันไม่พึงประสงค์น้อยกว่าเมื่อเทียบกับ การศึกษาอื่น

Effect of Partial Body Weight Support Treadmill Training in Chronic Stroke Patients

Areerat Suputtitada MD*,
Pongsak Yooktanant MD**, Thakonwan Rarerng-Ying PT, MSc***

* Department of Rehabilitation Medicine, Faculty of Medicine, Chulalongkorn University

** Department of Orthopaedic Surgery, Faculty of Medicine, Chulalongkorn University

*** Sport Medicine Program, Faculty of Medicine, Chulalongkorn University

Objective : To compare the effect of Partial Body Weight Support Treadmill Training (PBWSTT) technique and floor walking training, on floor walking velocities and functional balance in chronic stroke patients.

Design : An observer blinded, randomized controlled trial.

Material and Method : Forty-eight chronic stroke patients were randomized into either the experimental group that received PBWSTT (n=24) or the control group that received floor walking training (n=24). Both groups received 25 minutes of daily walking training 5 days per weeks, totally 4 weeks. Treatment outcomes were assessed on floor walking velocities and functional balance by Berg Balance Scale

Results : There was no statistically significant difference between both groups after a 4-week training period with regard to floor walking velocities and functional balance at $p < 0.05$. Patients in both groups had statistically significant improvement in these variables after a 4-week training period when compared to before training at $p < 0.05$.

Conclusion : The efficacy of PBWSTT in chronic stroke patients was not statistically different to the efficacy of floor walking training in floor walking velocities and functional balance.

Keywords : Partial Body Weight Support Treadmill Training (PBWSTT), Chronic stroke patients

J Med Assoc Thai 2004; 87 (Suppl 2): S107-11

e-Journal: <http://www.medassochai.org/journal>

Restoration of gait is a major goal in neuro-rehabilitation of stroke patients. Three months after a stroke, approximately 20% of survivors remain primary wheelchair users, 20% have restoration of gait and walking capacity is limited in another 60% of patients⁽¹⁾. The gait pattern of a patient following a stroke is characterized by problems with generating, timing and grading of muscle activity, hypertonicity, and mechanical changes in soft tissues⁽²⁾. Gait speed, stride length, and cadence are lower than normal values⁽²⁾.

Modern concepts favor a motor relearning program, that is a task-specific, repetitive approach⁽³⁾ to walking training, and clear benefit from more intensive therapy has been demonstrated⁽⁴⁾. A new method for reeducating gait in patients with neurological disorders, Partial Body Weight Support Treadmill Training (PBWSTT) was first introduced by Finch and Barbeau

⁽⁵⁾. Researchers have used PBWSTT for patients with spinal cord injury⁽⁶⁻⁷⁾ and stroke⁽⁸⁻¹³⁾. Improvements in temporal/discharge gait variables (stride length, cadence, gait speed, and swing and stance symmetry) and electromyographic patterns of patients receiving PBWSTT following stroke have been noted in the literature⁽⁸⁻¹²⁾. Results offer promise for increasing the ability of patients to walk after a stroke; however, there are limitations in these studies. In Thailand, there has been no study on the effect of PBWSTT.

Objective

The objective of this study was to compare the effect of Partial Body Weight Support Treadmill Training (PBWSTT) technique and floor walking training on walking velocity and balance in chronic stroke patients.

Ethics

The study was approved by the Ethics Committee of Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand.

Correspondence to : Suputtitada A. Department of Rehabilitation Medicine, Jarern-Somsri Building, Floor 1, Faculty of Medicine, Chulalongkorn University, Rama IV Road, Patumwan, Bangkok 10330, Thailand. Phone: 0-2256-4433, Fax: 0-2256-4433, E-mail: sareerat@hotmail.com, trcaan@md2.md.chula.ac.th

Study Design

The present study was an observer blinded, randomized controlled study.

Material and Method

Subjects

Forty-eight stroke patients were recruited into the present study with the following criteria: (1) duration since onset of stroke was longer than 6 months; (2) able to sit at the edge of the bed independently; (3) independently ambulation with or without a gait aid; (4) no cardiac risk factors; (5) able to communicate with the therapists; (6) willing to participate in the study. The exclusion criteria were (1) having hyperkinetic movement disorders; (2) using orthosis or prosthesis; (3) unwilling to participate in the study; (4) training less than 2 consecutive weeks.

Interventions

The patients were randomized by a block of four into two groups, the experimental and the control group. Gait training duration was 25 minutes per day for 4 weeks in both groups.

The experimental group-PBWSTT

Each subject was mechanically supported in a modified parachute harness supported centrally by a set of pulleys connected to a flexible spring. The harness supported the patients primarily about the pelvis, lower abdomen, and chest to avoid interfering with lower limb movement. Initially, two therapists were required to assist the patient's movement on the belt, so that the patient could practice stepping not only repetitively but also in a correct manner. One therapist, who sat alongside, helped with the swing of the paretic limb and ensured that initial contact was made with the heel, while preventing hyperextension of the knee and controlling the symmetry of steps. The second therapist, standing behind the patient, assisted with weight shift onto the stance limb and promoted hip and trunk extension by applying a firm pressure with the thumb on the rear of the pelvis or with a flat hand on the chest. This therapist also prevented the patient's swinging in the harness: such swinging had to be strictly avoided because it prevented limb loading and causing continuous hip flexion. Treadmill velocities used permitted walking to be initiated from 0.044 m/s 10 minutes, rest for 5 minutes and then increased by increment of 0.044 m/s 10 minutes, totally 25 minutes. On the following day, treadmill velocities started from the velocities that the patient could walk on the former day. Partial body

weight support (PBWS) was 30% during the first week, 20% during the second week, 10% during the third week and no BWS during the fourth week.

The control group-Floor walking

Patients walked at self-adopted speed on a 15 m walkway for 10 minutes, rested 5 minutes and then walked 10 minutes, totally 25 minutes.

Assessment tools

The assessment tools were assessed prior to gait training and at the end of the 4th week as follows; (1) 10m timed walk on the floor for floor walking velocity; (2) Berg Balance Scale for functional balance of the body.

Statistical Analyses

The General Linear Models for Repeated Measures option in SPSS 11.0 for Windows 2000 was used to analyze each outcome measure. General characteristic data was analyzed by using mean and standard deviation and frequency distribution and tested for the difference at 5% significant level by unpaired t-test and Chi-square test, respectively. Walking velocities and Berg Balance Scale were analyzed by using mean, median, range and percentage of change. The difference of walking velocities and Berg Balance Scale before and 4 weeks after walking training within each group were analyzed by paired t-test and Wilcoxon signed rank test, respectively. The difference of walking velocities and Berg Balance Scale before and 4 weeks after training between the PBWSTT group and the control group were analyzed by unpaired t-test and Mann-Whitney U test, respectively. The level of statistical significance was set at 0.05.

Results

Demographic data

Forty-eight chronic stroke patients were randomized to either PBWSTT (n=24) or floor walking (n=24). There were 20 males (83.33%) and 4 females (16.67%) in the PBWSTT group, 15 males (62.5%) and 9 females (37.5%) in the control group. Mean ages in the PBWSTT group and the control group were 61.08 ± 10.21 and 64.88 ± 10.72 years old, respectively. Most were hemorrhage; that were 66.67% and 62.50% in the PBWSTT group and the control group, respectively. The sides of weakness were mostly on the right side in both groups. The durations since onset of stroke in the PBWSTT group and the control group were 27.33 ± 26.62 and 21.67 ± 27.72 months, respectively. The

floor walking velocities in the PBWSTT group and the control group were 0.41 ± 0.21 and 0.22 ± 0.13 m/s, respectively. The median of Berg Balance Scale in the PBWSTT group and the control group were 47.5 and 37 respectively. All demographic data in both groups are shown in Table 1.

During the intervention period, walking velocities on the floor and balance after training when compared to before training showed statistically significant improvement in both groups as shown in Table 2 and 3. The percentage of change of walking velocities on the

floor and balance were not statistically significantly different in both groups as shown in Table 2 and 3.

Discussion

The efficacy of PBWSTT in the present study was not statistically different to efficacy of floor walking training in walking velocities and functional balance. These results are inconsistent with those of previous studies evaluating PBWSTT for retraining gait in stroke patients⁽⁸⁻¹⁸⁾. For chronic non-ambulatory stroke patients, a multiple baseline studies showed that PBWSTT was more effective than regular physiotherapy in restoring gait ability and walking velocity⁽¹¹⁻¹²⁾. In pilot study on four stroke patients, Hassid et al⁽¹⁸⁾ reported better gait symmetry on a treadmill than with ground level walking. Normal subjects tended to use a faster cadence and shorter stride length on treadmill than during floor walking. In addition, the peak ankle dorsiflexion in stance, the peak hip extension at the end of stance, and the total vertical excursion of the head were less on the treadmill, while there was no difference with regard to the kinesiological electromyogram (EMG) and the energy expenditure^(19,20).

Hesse et al⁽¹⁴⁾ compared PBWSTT versus floor walking training in chronic ambulatory stroke patients. The study revealed that patients could practice a more favorable gait on PBWSTT. Gait was characterized by a higher symmetry and greater stimulus for balance training as indicated by a prolongation of the highly relevant single stance period of the affected lower limb. With regard to muscle activation, PBWSTT reduced the activity of relevant weight-bearing muscles,

Table 1. Demographic data of the study population

Characteristics	PBWSTT (n=24)	Floor walking (n=24)	p-value
Age (Yrs)	61.08±10.21 (41-84)	64.88±10.72 (46-83)	0.23 ¹
Gender (Male/Female)	20/4	15/9	0.12 ²
Etiology of stroke (Hemorrhage/ Infarction)	16/8	15/9	0.11 ²
Side of weakness (Right/Left)	15/9	16/8	0.16 ²
Duration since onset of stroke (Months)	27.33±26.62 (6-216)	21.67±27.72 (6-120)	0.12 ¹
Walking velocities (m/s)	0.41±0.21 (0.11-0.74)	0.22±0.13 (0.07-0.69)	0.06 ¹
Berg Balance Scale (0-56)	47.5 (25-53)	37 (11-49)	0.07 ¹

¹ P-value by unpaired t-test, significant at P < 0.05

² P-value by chi square test, significant at P < 0.05

Table 2. Comparison of walking velocities between before and 4 weeks after walking training

Assessment Tools	PBWSTT (N=24) Mean (Range)				Floor walking (N=24) Mean (Range)				P ²
	Before	4 weeks	Change	P ¹	Before	4 weeks	Change	P ¹	
Walking Velocities(m/s)	0.41±0.21 (0.11-0.74)	0.49±0.23 (0.20-0.86)	8.75±7.17	0.000*	0.22±0.13 (0.07-0.69)	0.28±0.16 (0.07-0.74)	5.50±5.39	0.000	0.083

¹ P-value by paired t-test, significant at P < 0.05

² P-value by unpaired t-test, significant at P < 0.05

Table 3. Comparison of Berg Balance Scale between before and 4 weeks after walking training

Assessment Tools	PBWSTT (N=24) Median (Range)				Floor walking (N=24) Median (Range)				P ²
	Before	4 weeks	Change	P ¹	Before	4 weeks	Change	P ¹	
Berg Balance Scale	47.5 (25-53)	50 (38-54)	4.46%	0.001*	37 (11-49)	41.5 (20-53)	8.03%	0.000*	0.187

¹ P-value by Wilcoxon signed rank test, significant at P < 0.05

² P-value by Mann-Whitney U test, significant at P < 0.05

compared with floor walking. Therefore, weight release during treadmill training should not be prolonged. In addition, plantar flexor spasticity, indicated by the amount of premature activity by the plantar flexors and the co-contraction of the shank muscles, was less in the PBWSTT group. Furthermore, the activation pattern of the erector spinae became more physiologic on the treadmill⁽¹⁴⁾.

The results of the present study are inconsistent with those of previous studies, the explanation was (1) the PBWSTT training velocities was less than the previous studies. The authors could not use the higher velocities as a previous study because our patients were not familiar with treadmill training. In foreign countries, treadmill training is included in the ordinary physiotherapy program, but in Thailand it is not. The velocities of the patients at the end of 4 weeks in PBWSTT were as floor walking velocities. Sullivan et al⁽²¹⁾ revealed that training speed with normal walking velocity was more effective than training at speeds at or below the patient's typical floor walking velocity. Moreover, the patients walked more efficiently at higher velocities, consuming less energy per distance covered, facilitating the activity of relevant antigravity muscles, economizing gait, and providing cardiovascular fitness⁽¹⁾; (2) the duration since onset of stroke in the present study was more prolonged than in previous studies. The patients had already learned nonuse by weight bearing only on normal side for many years. So that they cannot learn to put their body weights on the affected sides for balance within the 4-week training period. Further studies about training period in chronic stroke with prolonged duration since the onset of the stroke should be done. Otherwise, other methods that overcome learn nonuse such as constraint induced movement therapy for lower extremity may be used in combination with PBWSTT.

The other advantages of PBWSTT that the authors found were (1) less manpower of physical therapists, that may be more cost beneficial than floor training (2) increase confidence for the patients to walk independently because of harness suspension.

Conclusion

The efficacy of PBWSTT in chronic stroke patients was not statistically different to the efficacy of floor walking training in walking velocities and functional balance.

References

1. Hesse S, Werner C, von Frankenberg S, Bardeleben A. Treadmill training with partial body weight support after

- stroke. *Phys Med Rehabil Clin N Am* 2003; 14(1 Suppl): S111-23.
2. Olney SJ, Richards C. Hemiparetic gait following stroke, part I: characteristics. *Gait & Posture* 1996; 4: 136-48.
3. Carr JH, Shepherd RB. A Motor relearning programme for stroke. London. Heinemann Physiotherapy 1987.
4. Kwakkel G, Wagenaar RC, Twisk JWR, Lankhorst GJ, Koestier JC. Intensity of leg and arm training after primary middle cerebral artery stroke: a randomized trial. *Lancet* 1999; 354: 191-6.
5. Finch L, Barbeau H. Hemiplegic gait: new treatment strategies. *Physiotherapy Canada* 1986; 38: 36-41.
6. Visintin M, Barbeau H. The effects of body weight support on the locomotor pattern of spastic paretic patients. *Can J Neurol Sci* 1989; 16: 315-25.
7. Norman K, Pepin A, Ladouceur M, Barbeau H. A treadmill apparatus and harness support for evaluation and rehabilitation of gait. *Arch Phys Med Rehabil* 1995; 76: 772-8.
8. Pillar T, Dickstein R, Smolinski Z. Walking reeducation with partial relief of body weight rehabilitation of patients with locomotor disabilities. *J Rehabil Res Dev* 1991; 28: 47-52.
9. Hesse S, Helm B, Krajnik J, Gregoric M, Mauritz KH. Treadmill training with partial body weight support influence of body weight release on the gait of hemiparetic patients. *J Neurobiol Rehabil* 1997; 11: 15-20.
10. Waagfjord J, Levangie PK, Certo CM. Effects of treadmill training on gait in a hemiparetic patient. *Phys Ther* 1990; 70: 549-58.
11. Hesse S, Bertelt C, Schaffrin A, et al. Restoration of gait in nonambulatory hemiparetic patients by treadmill training with partial body weight support. *Arch Phys Med Rehabil* 1994; 75: 1087-93.
12. Hesse S, Bertelt C, Janke MT, et al. Treadmill training with partial body weight support compared with physiotherapy in nonambulatory hemiparetic patients. *Stroke* 1995; 26: 976-81.
13. Visintin M, Barbeau H, Korner-Bitensky N, Mayo NE. A new approach to retrain gait in stroke patients through body weight support and treadmill stimulation. *Stroke* 1998; 29: 1122-8.
14. Hesse S, Konrad M, Uhlenbrock D. Treadmill walking with partial body weight support versus floor walking in hemiparetic subjects. *Arch Phys Med Rehabil* 1999; 80: 421-7.
15. Kosak MC, Reding MJ. Comparison of partial body weight-supported treadmill gait training versus aggressive bracing assisted walking post stroke. *Neuro-rehabil Neural Repair* 2000; 14: 13-9.
16. Filho IT, Lim PAC, Qureshy H, Henson H, Monga T, Probst EJ. A comparison of regular rehabilitation and regular rehabilitation with supported treadmill ambulation training for acute stroke patients. *J Rehabil Res Dev* 2001; 38: 245-55.
17. Nilsson L, Carlsson J, Danielsson A, Fugl-Meyer A, Hellstrom K, Kristensen L, et al. Walking training of patients with hemiparesis at an early stage after stroke: a comparison of walking training on a treadmill with body weight support and walking training on the ground. *Clin Rehabil* 2001; 15: 515-27.
18. Hassid E, Rose D, Commisarow J, Guttry M, Dobkin BH. Improved gait symmetry in hemiparetic stroke patients induced during body weight-supported treadmill stepping. *J Neurol Rehabil* 1997; 11: 21-6.

19. Murray MP, Spurr GB, Sepic SB, Gardner GM, Mollinger LA. Treadmill VS. Floor walking: kinematics, electromyogram, and heart rate. *J Appl Physiol* 1985; 59: 87-91.
20. Stoze H, Kuhtz-Buschbeck JP, Mondwurf C, Boczek-Funcke A, Johnk K, Deuschl G, et al. Gait analysis during treadmill and floor locomotion in children and adults. *Electroencephalogr Clin Neurophysiol* 1997; 105: 490-7.
21. Sullivan KJ, Knowlton BJ, Dobkin BH. Step training with body weight support: Effect of treadmill speed and practice paradigms on poststroke locomotor recovery. *Arch Phys Med Rehabil* 2002; 83: 683-91.

ผลของการฝึกเดินบนลู่วิ่งสายพานร่วมกับการพุงน้ำหนักของร่างกายบางส่วนในผู้ป่วยอัมพาตครึ่งซีกเรื้อรัง

อารีรัตน์ สุพุทธิธาดา, พงศ์ศักดิ์ ยุกตะนันท์, ถกลวรรณ ร่ำเรืองยิ่ง

วัตถุประสงค์ : เปรียบเทียบผลของการฝึกเดินบนลู่วิ่งสายพานร่วมกับการพุงน้ำหนักของร่างกายบางส่วน กับการฝึกเดินบนพื้น ต่อความเร็วของการเดินบนพื้น และ ความสมดุลของร่างกายขณะทำกิจกรรมในผู้ป่วยโรคหลอดเลือดสมองเรื้อรัง

รูปแบบการวิจัย : An observer blinded, randomized controlled trial

วัสดุและวิธีการ : ผู้ป่วยโรคหลอดเลือดสมองเรื้อรัง 48 คน แบ่งแบบสุ่มเป็นกลุ่มทดลองที่ฝึกโดยเดินบนลู่วิ่งสายพานร่วมกับการพุงน้ำหนักของร่างกายบางส่วน และ กลุ่มควบคุมที่ฝึกเดินบนพื้น กลุ่มละ 24 คน ทั้งสองกลุ่มได้รับการฝึกเดิน นาน 4 สัปดาห์ ๆ ละ 5 วัน วันละ 25 นาที ประเมินผลด้วยความเร็วของการเดินบนพื้น และความสมดุลของร่างกายขณะทำกิจกรรม

ผลการศึกษา : ความเร็วของการเดินบนพื้น และ ความสมดุลของร่างกายขณะทำกิจกรรม หลังการฝึกที่ 4 สัปดาห์ ระหว่างทั้งสองกลุ่ม ไม่แตกต่างกันอย่างมีนัยสำคัญทางสถิติที่ $p < 0.05$ และ เมื่อสิ้นสุดการฝึกที่ 4 สัปดาห์ ผู้ป่วยทั้งสองกลุ่ม มีความเร็วของการเดินบนพื้น และความสมดุลของร่างกายขณะทำกิจกรรม เพิ่มขึ้นจากก่อนรับการฝึกอย่างมีนัยสำคัญทางสถิติที่ $p < 0.05$

สรุป : ประสิทธิภาพของการฝึกในผู้ป่วยโรคหลอดเลือดสมองเรื้อรังด้วยเทคนิคฝึกเดินบนลู่วิ่งสายพานร่วมกับการพุงน้ำหนักของร่างกายบางส่วน ไม่แตกต่างจากการฝึกเดินบนพื้นในด้านความเร็วของการเดินบนพื้น และความสมดุลของร่างกายขณะทำกิจกรรม