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II.

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III.

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12.	26
IV.		
1.	27
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V.	35
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1.	10
2. ink foot-print	10
3. F- scan	11
4. F- scan	12
5.	15

2000 4 17 5 4

가

24

12 (8 , 4)

ink foot-print

F- scan(Tecscan, USA)

t- , t- ,

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I.

1.

가 (Deaver, 1967 ; Perlstein, 1949).

(Bobath, 1984 ; Marks, 1974).

가 (Norkin Levangie, 1982)

(Bobath, 1991).

Bobath(1984)

가 . Alcan (1997)

Hamrin (1982) Dettmann (1987)

가 . (1998)

(1982) Hocherman
(platform)

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Liao (1997)

(Perlstein, 1949

; Phelps, 1948). Murray(1967)

(Bobath, 1984 ; , 1996)

(platform)

(Richard, 1986). 가 가

(Shumway 1988).

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, foot- scan

(1996)

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(Alexander, 1990),

(1997)

(COP)

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foot scan

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foot

scan

ink foot print

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가 1.

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가 2.

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II.

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2000 4 17 5 4

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2.

Tecscan

F-scan version 4.12F ,

Boenig(1977) ink foot-print (temporal distance) Shores(1980)가

1) (temporal distance) :

2) (gait velocity): ,
cm/sec .

3) (cadence):
 , / .

4) (stride length):
 .

5) (step length):
 .

6) (step):

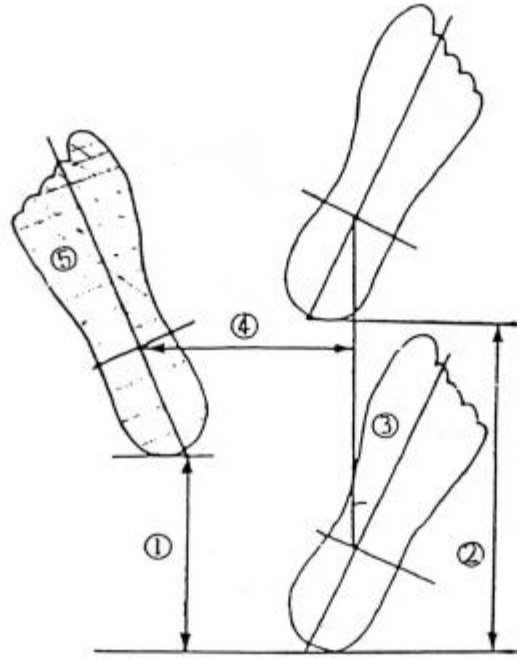
7) : 가 가
1/3 ,

8) (base of support): 가
가 1/3 ,

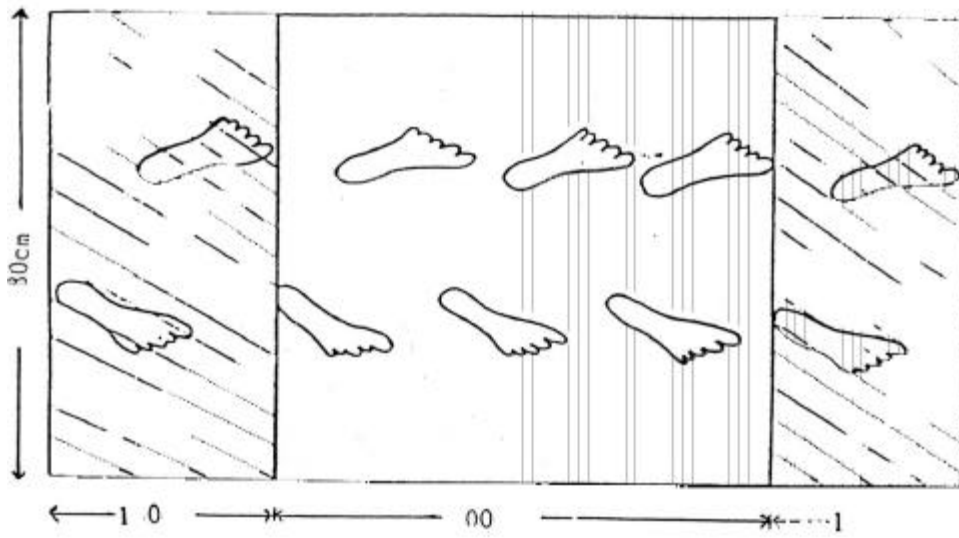
(heel- strike) 150 cm
 (toe- off) . Ink foot- print 가
 150 cm 150 cm 500 cm
 , 3
 가 , ,
 .
 7) 30 6)

F- scan(Tecscan, USA)

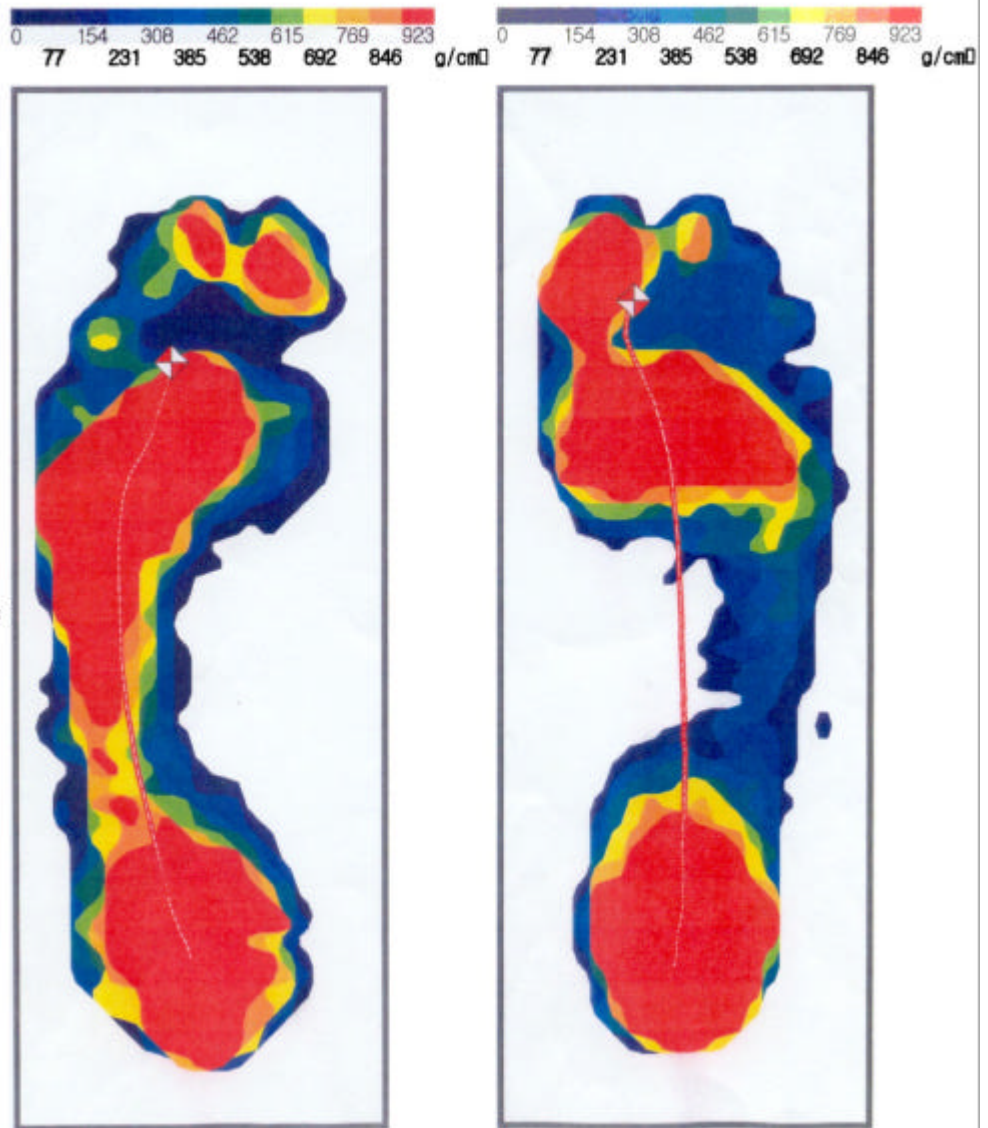
1) foot mat
 (COP) .
 2) 30 foot mat (COP) .
 1000 frame 200 frame 600 frame
 ,
 .



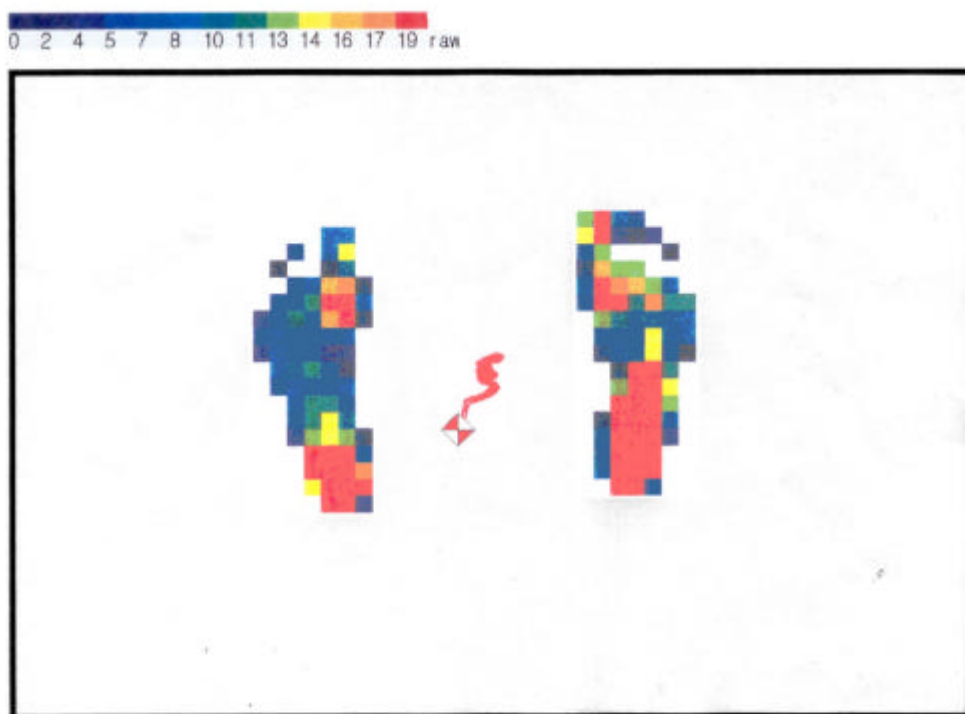
1.



2. Ink foot print



3. F-scan



4. F- scan

4.

1.

5.

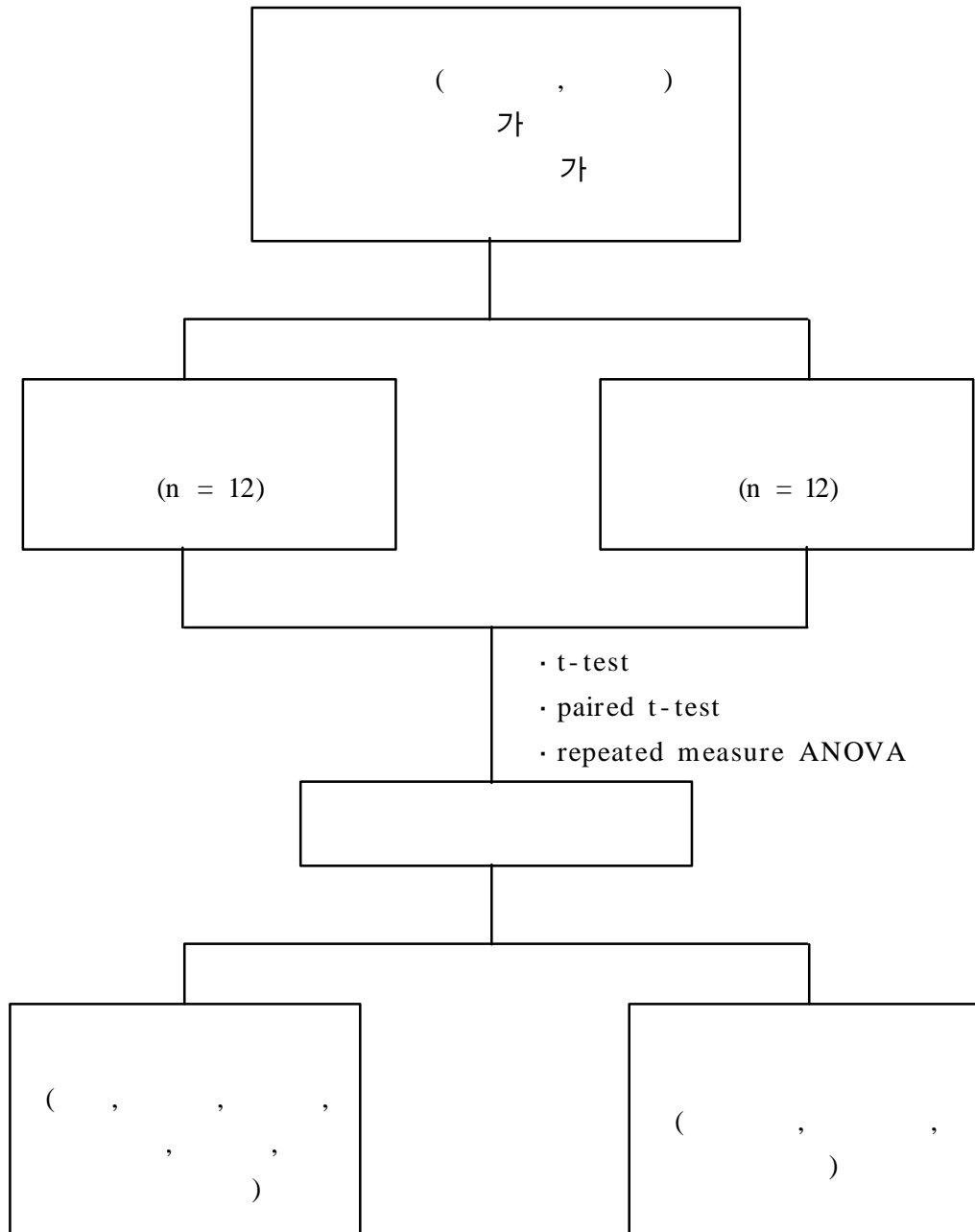
가

SAS(Statistical Analysis System)

.

t- ANOVA) t- , (repeated measure
.
< 0.05 .

6.



5.

2.

(n=24)

		7	58.3	5	41.7
		5	41.7	7	58.3
	5	3	25.0	5	41.7
	6 10	7	58.3	7	58.3
	11	2	16.7	0	0
	$(\bar{x} \pm SD)^*$		7.2 ± 3.04		6.3 ± 2.01
	80 90	1	8.3	1	8.3
	91 100	1	8.3	5	41.7
(cm)	101 110	6	50.0	2	16.7
	111 120	2	16.7	1	8.3
	120	2	16.7	3	25.0
	$(\bar{x} \pm SD)^*$		113.5 ± 21.70		104.4 ± 12.22
	10 15	3	25.0	6	50.0
	16 20	3	25.0	2	16.7
(kg)	21 25	4	33.3	2	16.7
	26	2	16.7	2	16.7
	$(\bar{x} \pm SD)^*$		23.6 ± 14.10		18.2 ± 6.38
		8	66.7	8	66.7
		4	33.3	4	33.3
		12	100.0	12	100.0

, , t-test 가

2.

가 (3).

3.

	±		p - value
	(n=12)	(n=12)	
(cm)	48.7 ± 19.82	47.4 ± 21.18	0.818
(cm)	26.3 ± 10.01	24.0 ± 10.79	0.585
()	9.5 ± 7.70	12.1 ± 9.22	0.475
(cm ²)	64.7 ± 20.11	63.0 ± 8.60	0.460
(cm)	17.0 ± 4.27	14.0 ± 3.76	0.077
(/)	94.6 ± 37.97	102.7 ± 51.80	0.666
(cm/)	46.3 ± 27.04	51.5 ± 27.85	0.491

3.

가
(4).

4.

	±		p- value
	(n=12)	(n=12)	
(cm)	50.6 ± 17.67	44.0 ± 11.78	0.299
(cm)	26.7 ± 8.79	21.2 ± 7.14	0.107
(°)	10.8 ± 6.53	10.3 ± 7.63	0.623
(cm ²)	70.4 ± 20.23	61.2 ± 13.86	0.029
(cm)	18.2 ± 3.80	16.9 ± 3.63	0.416
(/)	84.6 ± 36.92	98.1 ± 64.68	0.534
(cm/)	39.7 ± 26.15	30.1 ± 21.95	0.339

4.

5.7 cm²가

,
(5).

5.

(n=12)

	±		p-value
(cm)	48.7 ± 19.82	50.6 ± 17.67	0.712
(cm)	26.3 ± 10.01	26.7 ± 8.79	0.338
()	9.5 ± 7.70	10.8 ± 6.53	0.528
(cm ²)	64.7 ± 20.11	70.4 ± 20.23	0.002
(cm)	17.0 ± 4.27	18.2 ± 3.80	0.295
(/)	94.6 ± 37.97	84.6 ± 36.92	0.271
(cm/)	43.6 ± 27.04	39.7 ± 26.15	0.387

5.

, , , ,
(6).

6.

(n=12)

	±		p- value
(cm)	47.4 ± 21.18	44.0 ± 11.78	0.516
(cm)	24.0 ± 10.79	21.2 ± 7.14	0.297
(°)	12.1 ± 9.22	10.3 ± 7.63	0.545
(cm ²)	63.0 ± 8.60	61.2 ± 13.86	0.260
(cm)	14.0 ± 3.76	16.9 ± 3.63	0.063
(/)	102.7 ± 51.80	98.1 ± 64.68	0.858
(cm/)	51.5 ± 27.85	30.1 ± 21.95	0.007

6.

가

가

(7).

7.

	±		p - value
	(n=12)	(n=12)	
(cm)	1.9 ± 16.20	- 3.4 ± 16.99	0.479
(cm)	0.4 ± 6.29	- 2.8 ± 8.82	0.434
()	1.4 ± 7.03	- 1.7 ± 7.22	0.488
(cm ²)	5.7 ± 4.46	1.9 ± 4.85	0.005
(cm)	1.1 ± 3.60	2.9 ± 4.26	0.278
(/)	- 10.0 ± 29.89	- 4.5 ± 85.81	0.838
(cm/)	- 3.9 ± 15.05	- 21.4 ± 22.81	0.037

7.

가 (8).

8.

	±		p- value
	(n=12)	(n=12)	
(cm)	7.3 ± 7.21	3.2 ± 3.94	0.103
(cm)	7.4 ± 7.45	3.8 ± 2.25	0.115
(.)	6.3 ± 6.92	11.0 ± 7.71	0.133
(cm ²)	8.0 ± 8.08	6.0 ± 6.04	0.499

8.

(9).

9.

	±		p- value
	(n=12)	(n=12)	
(cm)	1.4 ± 4.17	4.2 ± 4.93	0.023
(cm)	2.9 ± 5.16	6.5 ± 3.11	0.037
()	7.6 ± 6.35	10.2 ± 7.47	0.371
(cm ²)	1.6 ± 6.01	1.0 ± 8.77	0.031

9.

가

(10).

10.

		±		p- value
		(n=12)	(n=12)	
(cm)	(n=12)	2.8 ± 0.90	0.976	
	(n=12)	2.9 ± 1.67		
(cm)	(n=12)	2.6 ± 1.28	0.477	
	(n=12)	3.3 ± 3.19		
(cm ²)	(n=12)	133.8 ± 33.30	0.220	
	(n=12)	116.7 ± 31.99		

10.

,
(11).

11.

(n=12)

	\pm	p- value
(cm)	2.8 ± 0.90	0.0003
	2.1 ± 4.84	
(cm)	2.6 ± 1.28	0.005
	2.0 ± 1.05	
(cm ²)	133.8 ± 34.30	0.029
	125.9 ± 38.17	

11.

,
(12).

12.

(n=12)

	±	p-value
(cm)	2.9 ± 1.67	0.075
	2.2 ± 1.05	
(cm)	3.3 ± 3.19	0.106
	2.4 ± 1.73	
(cm ²)	116.7 ± 31.99	0.182
	112.7 ± 32.36	

12.

가

(13).

13.

		±	p-value
(cm)	(n=12)	0.7 ± 0.49	0.878
	(n=12)	-0.7 ± 1.21	
(cm)	(n=12)	-0.6 ± 0.63	0.574
	(n=12)	-1.0 ± 1.90	
(cm ²)	(n=12)	-7.9 ± 10.92	0.353
	(n=12)	-3.9 ± 9.55	

IV.

1.

(, 1994).

가

(Gage, 1991).

, , ,

,

가

(,

1999).

가

(Gunsolus, 1975; Cooper, 1978).

Botox ,

,

(Joel, 1993).

가

가

(Bobath, 1991).

1960 Karpovich Electrogoniometer
 1964 Murray Drought가
 photograph 1968 Perry foot switch
 1971 Sutherland Hagy 1974
 Winter Kuryliak Cine film computer
 . 1980
 3 ,
 가 , ,
 (, 1998).

(, 1995 ; Corcoran , 1970 ;
 Boenig, 1977 ; Blanke, 1986). Boenig(1977)

가

Shores(1980)

가

ink-foot print

(1995; Boenig, 1977 ; Holden , 1984). Alexander
(1990)

. Murray(1975) Winter (1990)

가 .

가

가

(COP)

가 가

(COF trajectory)

.

ink-foot print

Tecscan

F- scan

version 4.12 F

1000

frame

200 frame

600 frame

,

. ink-foot print F- scan

Shores가

가가

가

2.

Bobath

5.7 cm² 가

1.9 cm

10 /

0.9 cm/

1.2 cm 가

가

(1996) platform

가 0.7 cm

가 0.6 cm

7.9 cm²

가

Liao (1997)

가

2.9 cm 가

3.4 cm

1.8 ° 1.8 cm²

21.4 cm/ 가 가

가 Gage(1991) ,

, ,

, 가

(1999) (1999)

가

(1999) Botox

, , 가

, .

9.2 cm²

(foot

contact area) 가

5

(longitudinal arch) (transverse arch)

가

가

(Cooper, 1978; Crenna, 1998).

6.6 가 가 16.5cm/

. Wong (1983)

가 ,

가

. , Perry(1992) 5 17

가 64 cm/ 50 cm/

Gage(1991) 가 119 cm/

, 72 83 cm/ .

가 35 43.6 cm/ , , ,

Bobath(1991)가

0.9 cm

0.6 cm

cm²가 . Kuan (1999)

6.3

가

가,

가

가

Liao (1997)

3.

ink-foot print

가

(carry over)

(8m)

가

가

가

V.

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1998; 22: 1107- 1113

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1994; 18: 736-741

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1999; 23: 504- 515

, , , , , . 1996; 20:
848- 857

, , , , . 1999; 23: 1127- 1133
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1997; 21: 762-771

가

1996

Stance Phase

1996; 20: 524-531

1997

1998; 22:

1206- 1218

1998; 22: 1123- 1128

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Abstract

Changes in gait parameters and foot contact area, and center of pressure of foot after mobile weight bearing exercise and range of motion exercise in the children with cerebral palsy.

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Health Science and Management

Yonsei University

(Directed by Professor Chang-il Park, M.D.)

The purpose of this study was to determine the immediate effect of mobile weight bearing exercise and range of motion exercise in the children with cerebral palsy(CP) affect on gait patterns and center of pressure of foot.

Twenty-four children with spastic cerebral palsy participated in this study. All have been treated with regular physical therapy in the Department of Rehabilitation, Yonsei University College of Medicine.

These subjects were randomly assigned into two groups; mobile weight bearing exercise group and range of motion exercise group. Each group consisted of twelve patients; eight diplegic CP and four

hemiplegic CP. Gait characteristics were evaluated using ink-foot print method and the center of pressure of foot was assessed by F-scan(Tecscan, USA). The repeated measure ANOVA and independent t-test and paired t-test were used for statistical analysis.

The results of this study are as follows;

1. The area of foot contact was significantly increased after mobile weight bearing exercise. Stride length, base of support, and foot angle were not significantly changed after mobile weight bearing exercise.
2. Gait velocity was significantly decreased, but stride length, foot angle, base of support and area of foot contact were not significantly changed after range of motion exercise.
3. There were statistical significant differences in a symmetry of stride length, step length and area of foot contact between both groups after exercise.
4. There were statistical significant decrease in the anteroposterior and mediolateral displacement of center of pressure and total pressure area after mobile weight bearing exercise.
5. There were no statistical significant changes in the anteroposterior and mediolateral displacement of center of pressure and total pressure area after range of motion exercise.

6. There were no statistical significant differences in the anteroposterior and mediolateral displacement of center of pressure and total pressure area between either group after exercise.

Conclusively, this study suggests that mobile weight bearing exercise have positive effects on improving the area of foot contact and center of pressure of foot changes in standing and simultaneously enhancing symmetricity in regards to stride length, step length and area of foot contact.