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Effects on Exercise Training in person with Incomplete Hemisection cord injury after Discharge

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불완전 척수손상자의 퇴원 후 운동훈련의 효과 사례보고

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국문 초록

이 사례연구는 2002년 10월 15일 칼에 의한 좌상으로 경추 3-4번의 불완전 척수손상을 입은 25세의 남자 환자가 최초 병원에서 2002년 12월 한달 간의 치료를 마친 후, 2003년 1월 3일부터 4월 28일까지 태릉에 위치한 N 재활센터에서 주 5회 2시간의 자세조절 훈련, 심폐지구력 훈련, 웨이트 훈련, 스포츠(축구, 소프트 볼), 여가활동(등산)의 프로그램을 적용하여 척추손상 환자의 사회적응을 돕기위한 재활 프로그램의 다양화를 꾀하기 위한 기초 선행 작업으로 시작되었다. 신체능력을 평가하기 위한 측정도구는 관절가동범위(Range of Motion), 수동근력검사(Muscle Manual Test), 경직(Spasticity), 신체체력(Physical Fitness), 발란스(Balance: one leg stand), 상대적인 등속성 하지근력(Isokinetic Muscle Strength) 그리고 신체조성(Body Composition)로 하였다. 재활기간을 통해 처음 시작 일자에서 45일 간격으로 3차례의 측정을(1월 3일부터 4월 28일까지 실시하였다) 실시하였다. 최초 환자의 상태는 부분적으로 일상생활의 도움을 받아야 하는 상태로 동작을 시작하려 할 때 경직이 발생되어 옷을 입고 벗기, 신발 신고 벗기, 운전, 식사, 보행과 계단보행, 경사보행에서 보조자의 도움이 필요했으며, 작은 물건 잡기와 글씨쓰기, 타이핑 작업은 불가능 한 상태였다. 또한 스포츠 활동과 여가활동 역시 불가능 한 상태였다. 3달 15일간의 기간 동안 환자는 복학을 준비하기 위해 적극적으로 치료에 임했으며, 결과는 다음과 같았다. 신체조성은 재활 훈련을 통해 체중, 체지방율(%), 복부지방율(WHR)의 많은 감소를 가져

왔다. 경직을 측정하는 Ashworth Scale은 정상에 가깝게 감소하였다. 관절가동범위는 고관절, 무릎, 발목에서 모두 증가하였다. 수동근력검사(0-9)는 많은 향상을 가져왔다. 신체체력능력 항목에서 근지구력의 윗몸일으키기와 팔굽히기, 악근력, 유연성으로 앉아 체간 숙이기, 민첩성으로 사이드 스텝, 순발력의 서전트는 모두 크게 향상되었다. 환자의 일상능력에서도 옷을 입고 벗기, 신발 신고 벗기, 운전, 식사, 보행과 계단보행, 경사보행에서 보조자의 도움이 필요없었으며, 타이핑 작업은 5손가락을 모두 사용하지는 않았지만, 1분에 80타로 큰 향상을 가져왔다. 또한 축구와 소프트볼, 등산을 달에 1회 정도 실시하여 약간의 도움만으로 가능하게 되었다.

Key words: 척수손상, 운동훈련 프로그램

"본 연구는 2003년 대구 유니버시아드 학술 발표자료 임"

I. Introduction

Hemisection of the spinal cord (damage to one side) is typically caused by stab wounds. Incomplete hemisection cord injury with motor weakness on the ipsilateral(same) and sensory loss on the contralateral (opposite) (Susan B. O' sullivan et al 1988). It becomes hyper-reflexic and leads increased muscle tone, spasms, and spasticity(Susan B. O'sullivan et al 1988, Jae Sund Ahn, 2000). And several deficits in activity of daily living, movement deficits, atypical movements and compensations which are a direct result of loss muscular strength, loss control abnormal or aberrant movement (Susan Ryerson et al, 1997).

Exercise training is expected as an important factor to develop, maintain, and improve the level of physical activity during rehabilitation, further more is helpful to get a job and to go with others after return social life and home(Chang Il, Park, 1998). But It is very rear that papers are relate to effects on exercise about patients with Incomplete hemisection cord injuries.

This case study was to introduce an exercise training effects and to investigate changes in Physical ability, Spasticity, Activities of daily living (ADL), and Body composition during the exercise training of person with Incomplete hemisection cord injury after discharge.

II. Methods and Measurement

The subject was male (25 year olds) and had C3-4 Incomplete hemisection due to Stab wound in 2002/10/15 and had right motor weakness and left sensory loss. he started exercise in center 2003/1/03.

Body composition (INBODY 3.0) is measured as Body weight, Body fat(%), Muscle mass(kg), Fat distribution. Physical ability is measured as Range of motion is measured hip (supine, sit), knee(supine), ankle(supine) and Muscle Manual Test(0-9) is measured as strength of the upper and lower extremities, fingers, and ankle by Lowman Method of Grading. Fitness Test (Helmas) is measured as Sit-up, Push-up in endurance, and Grasp in strength, Side-step in agility, Surgent in power, and Flexibility. Balance Test is measured as

Table 1. Data of Body composition, Physical activity, and Spasticity compare to before and after Exercise Training

CONTENT		03, Jun	16, Feb	28, Apr
ROM(degree)	Rt Hip(supine)	45	60	70
	Lt Hip(supine)	60	70	70
	Rt Hip(sit)	10	15	20
	Lt Hip(sit)	15	20	20
	Rt Knee(supine)	120	125	135
	Lt Knee(supine)	125	135	135
	Rt Ankle(DF)	7	10	15
	Lt ANK(PF)	13	15	17
ADL	Cloth wear on/ off	need help	self control	self control
(Activity of Dairy living)	Shoe take on/off	need help	self control	self control
	Step up/down	need help	self control	self control
	gait(flat/slope)	need help	need help slope	self control
	drive	-	-	possible
	typing	-		60type/min
	leisure Activity	-	-	possible
	Sport Activity	-	-	possible
SPASTICITY	Wrist	2	1+	1
(Ashworth)	Ankle	2	1+	1
PHYSICAL	Rt Grasp Strength(kg)	0	26.7	32.5
	Lt Grasp Strength(kg)	0	20.3	34.6
	Sit-up(trial)	0	26	40
	Push-up(trail)	0	5	15
	Sargent(trial)	0	33	39
	Side-step(trial)	0	23	31
	Sit and Reach(cm)	-9.9	-9.1	-1.8
BALANCE	Rt Balance(sec)	3.25	8.74	28.69
	Lt Balance(sec)	15.37	27.83	72.36
STRENGTH(%)	Rt 60 flexion	40.6	64.6	78.5
	Lt 60 flexion	79.8	92.9	115.2
Peak Torque/	Rt 60 extension	128.5	194.1	229.6
Body Weight	Lt 60 extension	174.8	204.1	248.9
	Rt 30 Plantar Flexion	103.1	117.4	131.2
	Lt 30 Plantar Flexion	107.8	114.5	132.8
	Rt 30 Dorsi Flexion	26.7	34.2	38.2
	Lt 30 Dorsi Flexion	28	28.1	61.3
BODY	Weight(kg)	91.7	89.9	82
COMPOSITION	Muscle mass(kg)	58.2	58.3	57.7
	Body Fat(%)	33	31.6	25.5
	Waist Hip Raio	0.96	0.95	0.9

performance of time stand on one leg with visual. Isokinetic Strength Test (BIODEX) involved strength of knee extension and flexion and ankle plantarflexion and dorsiflexion. Asworth sacle(0,1,+1,2,3) is measured as spasticity intense. ADL (activity of daily living)Test is measured compare to independent or dependent of available movements(write, computer type, eat, wear cloth and shoe, drive, run slope, and sports activity). Subject did exercise training during 2 hours, 5 days per week and evaluated after 45days from first, 3 times. Data from this study presented a Test-Retest.

III. Results

Data of Body composition, Physical activity, and Spasticity compare to before and after Exercise Training is shown in Table 1.

1) Body composition

Body composition (Body weight, Body fat(%), Muscle mass(kg), Fat distribution) is decreased(Fig.1).

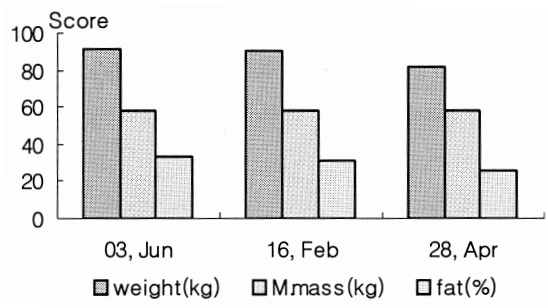

Fig 1. Body Composition

2) Physical activity

Range of Motion of hip, knee and ankle is increased as exercise goes(Fig 2).

Strength in ankle dorsiflexion of Muscle Manual Test is higher than first(6) and grade 8 is close to Normal strength. But finger grasp strength is grade 7.

Results of the Fitness Test followed Sit-up, Push-up in endurance, and Grasp in strength, Side-step in

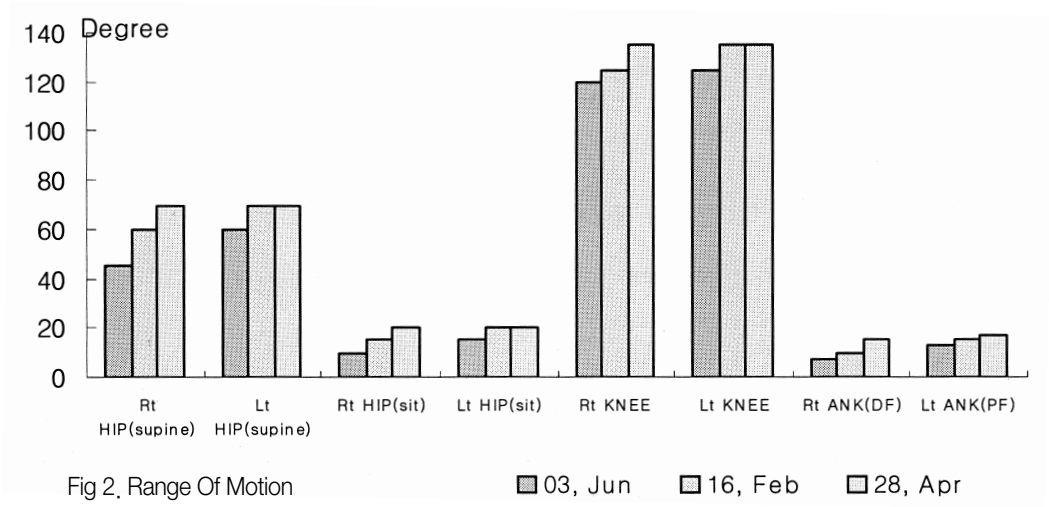

Fig 2. Range Of Motion

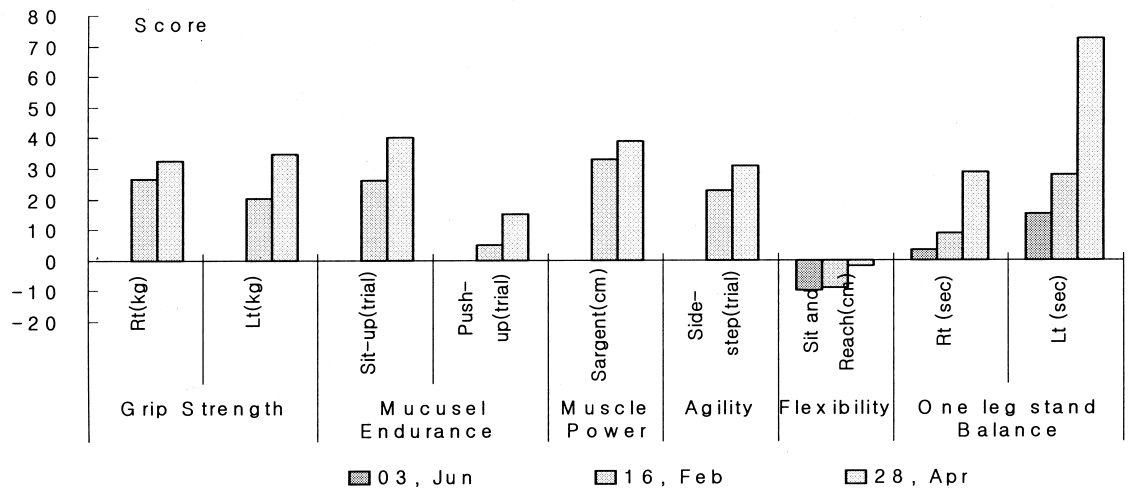

Fig 3. Physical Fitness

agility, Surgent in power wasn't performed at first test because spasticity. But performed frequency or intensity is increased at second and third test as exercise goes. Also Flexibility is increased during exercise. Balance is increased as exercise goes(Rt: 3.25, 8.74, 28.69, Lt: 15.37, 27.83, 72.36(Fig.3). Results Body weight per peak torque of the Isokinetic Strength of the knee flexion and extension about 60 degree per second increased through 3 times calculate(Rt flexion: 40.6, 64.6, 78.5, Lt flexion: 79.8, 92.9, 115.2, Rt extension: 128.5, 194.1, 229.6, Lt extension: 174.8, 204.1, 248.9) and Strength of ankle plantarflexion and dorsiflexion about 30 degree per second also increased(Rt dorsiflexion: 26.7, 34.2 38.2, Lt dorsiflexion:28, 28.1, 61.3, Rt plantarflexion: 103.1, 117.4, 131.2, Lt plantarflexion:107.8, 114.5, 132.8)(Fif 4).

3) ADL

ADL is involved write, computer type, eat, wear cloth and shoe, drive, run slope, and sports activity and effectively improved.

4) Spasticity

Spasticity is decreased and Ashworth Scale is normal as close to 0 and changed from 2 to 1.

IV. Discussion

These results indicate the presentstudy are also in agreement with Yarkony et al(1998), who found larger improvements in ADL performance in persons with incomplete SCI during the first 3yr after rehabilitation and improvement of muscle function can be the result of spontaneous neurological recovery, but can also be the effect of training. The strong correlations found in this study might be a result of Annet J Dallmeijer(1998), who concluded physical capacity and performance of ADL improved or remained constant during the first year after rehabilitation and that sport participation is associated with improvement in physical capacity so importance of being physical active during period

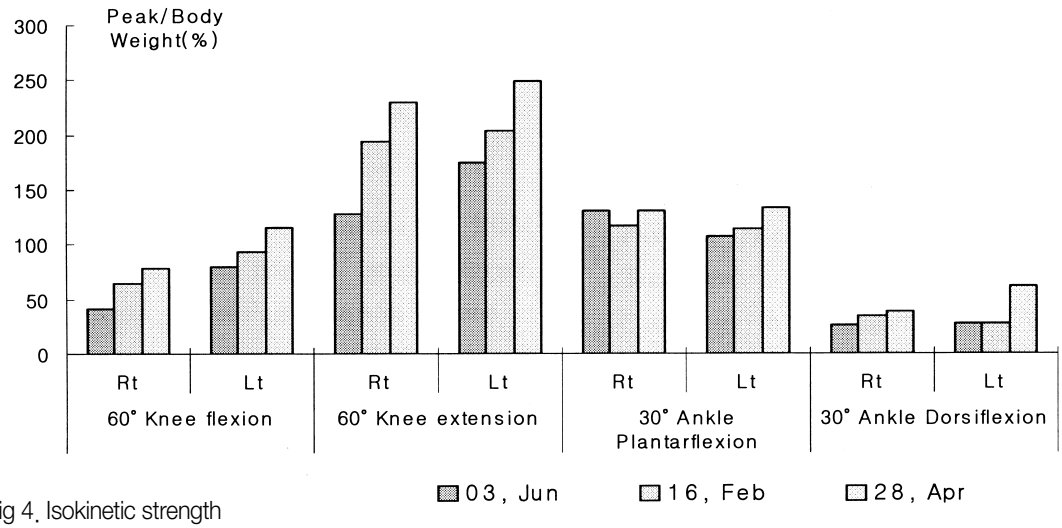

Fig 4. Isokinetic strength

after rehabilitation of persons with spinal cord injuries. The improvement of strength in this case study was in agreement with previous studies. The study of Thomas.W.J. & Janssen et al(1992), who found strong positive associations exist among upper body isometric strength, sprint power, and aerobic power in individuals with spinal cord injuries, which is probably due to the shared dependency on active muscle mass. Long term arm ergometry exercise training and submaximal weight exercise in persons with spinal cord injury was significant increase in upper body strength and physical function, level of perceived health and overall quality of life (Hicks AL, 2003).

Dallmeijer(1996) reported changes in performance of ADL during rehabilitation, physical strain remained constant and only improved performance time. This results is similar this case study. Ashworth Scale is improved but it' s not normal.

The improvement in performance of ROM and Balance in the present study agreed previous reports. Increasing range of motion is related to decreasing muscle tone range of motion (Booth et al, 1983; Jin Sang Kim et al, 1999). Limitation of the Strength, Range of motion, and flexibility makes difficult to control a normal posture and affects to establish balance (Shumway-Cook, Horak, 1990). Balance exercise for 12 weeks in patients with spinal cord injuries could increase the posturalstability in the dynamic or static condition. And it not only aroused the phasic contraction of antigravity muscle needed for postural control, but also could control muscle tone, which means the improvement of neuromuscular control (Yoo Sub, Kim et al,1999).

This case study contained another evaluate methods such as Body composition, Fitness Test, and Muscle Manual Test compare to previous reports and showed significantly change.

V. Conclusion

It is used evaluation methods; Range of Motion

,Body Compositon, Muscle Manual Test, Fitness, Balance, Intensity of Spasticity, Stresngth, ADL) to calculate exercise training effects forpatient with Incomplete Hemisection cord injury. But It' s not so very common that not to regarded all. For the more closely data related to SCI, future research present the number of subject are needed to increase for validity.

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