

편마비 증재에 신경생리학적 접근기법의 분석

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Analysis of Neurophysiological Approaches to the Intervention of Hemiplegia

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[국문 초록]

편마비 환자의 물리치료는 장애 결과를 완화시키는 것에 초점을 두고 있다.

본 연구는 신경생리학적 개념을 기초로 한 증재 접근 방법 중 편마비 환자에게 신경 발달 치료와 신경근 균형 접근 기법의 증재 효과를 비교 하였다.

연구 대상은 서울특별시와 전라북도에 소재한 종합병원 및 정형외과 의원에 입원 및 통원하고 있는 47-71세의 연령 범위에 있는 편마비 환자 30명 이다.

증재 집단의 기능적 능력 향상을 평가하기 위해 편마비 환자를 위한 운동 평가 척도와 수정된 바텔 척도를 평가도구로 사용하였다.

편마비 환자의 기능적 능력 향상을 평가도구에 의해 측정된 결과를 분석한 바 운동평가 척도 항목 중 바로누운 자세에서 옆으로 눕기와 앉아서 균형 취하기 영역에서, 수정된 바텔 척도 항목 중 식사하기 영역에서 통계적으로 유의한 차이를 보였다($P < .05$).

편마비 환자의 손상 부위, 손상 형태, 마비 부위 등의 손상의 본질에 따른 대상의 선정과 운동 조절 형태에 관한 지식 그리고 신경학적 결합 정도를 심도있게 다루어 기능적 능력 향상의 임상적 효과

를 검증하는 것이 중요하다.

Key Words : Hemiplegia; Neurodevelopmental treatment; Neuromuscular balance approach

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INTRODUCTION

Cerebral vascular disease is the third leading cause of death and the major cause of adult disability in the united states. It is estimated that more than 60% of all strok patients will have some functionally limiting disability as a result of the neurologic event(Gresham et al,1995; Kojima et al,1990; Sacco et al,1982).

Stroke was defined according to World Health Organization criteria; rapidly developed clinical signs of focal disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than vascular origin(WHO,1989).

Neurologic and functional recovery is most rapid within the first 3 months, but some patients continue to progress beyond that time(Anderson et al,1974; Andrews et al,1981; Dombovy et al,1987; Skilbeck et al,1985). The natural history of recovery from stroke after 3 months is mixed, with some payiemts improving, some remaining stable, and some demonstrating functional decline(Davidoff et al,1991; Ferrucci et al,1993).

Neuromuscular reeducation approach

have been advocated as more effective than Traditional treatment program approach in physical therapy after cerebrovascular accident(Bobath, 1959; Bobath, 1960; Brunnstrom, 1970). However, when first developed, these techniques were not subjected to clinical trials to demonstrate their efficacy and later trials revealed no outcome differences between two groups at time of hospital discharge (Logigian et al, 1983; Quin, 1971; Stern et al, 1970).

For post-cerebrovascular accident patients, to our knowledge three studies have compared NDT with Traditional Approach. Stern in a study of 62 patients found no significant difference at discharge in improvement of motility, leg strength or functional status between NDT and Traditional Approach groups. He also noted that NDT patients had longer average hospital stays than the Traditional Approach patient, although he did not determine whether this difference was statistically significant(Stern et al,1970). (Quin, 1971) found no obvious improvement in upper extremity dexterity and only small strength improvements after a one-month course of daily proprioceptive neurofacilitation treatment in four

patients. (Logigian et al, 1983) found no significant difference in Barthel index ratings and manual muscle testing in two groups of patients consist of 21 in each group, one receiving neurofacilitation the other receiving traditional therapy to the involved upper extremity.

In these three studies the results were evaluated at hospital discharge, and potential difference in carry over to the home environment were not evaluated. The present study compares long term outcomes of neurodevelopmental treatment and traditional approach for the post cerebrovascular accident patient. Specifically, it addresses functional abilities carried over into the home environment, involving both upper and lower extremities. We believe this paper is the first to report such long term comparisons. The purpose of this study is to demonstrate the effectiveness of intensive patient physical therapy of the hemiplegia survivor to increase functional status.

METHOD

This study was carried out in two general hospital and two orthopedic surgery clinics. The research design was planned as randomized clinical study.

thirty hemiplegic subjects(8 female)

Table 1. Comparison of Neuromuscular Balance(SOS) and Neurodevelopmental treatment(NDT) Approach

Approach	SOS	NDT
Tx Time	30-min sessions	45-min session
PT	Balance Reaction Neurofacilitation	Coordination Movement
Age(yrs)	56.7	55.6
Subjects(M/F)	11/4	11/4

participated in this study and hemiplegia stroke patients are consist of 17 right side(5 female) and 13 left side(3 female) hemiplegia stroke patients. The hemiplegic subjects ages ranged from 43 to 71(mean age,57.44; standard deviation,9.42)years. Fifty percent had a infarction stroke, 43% were ICH, and 7% had brain tumor.

One program utilized SOS whereas the other focused on NDT to promote isolated muscular control and Description of 30 subjects who participated in the study is summarized in table 1.

Study patients were selected by retrospective review of medical records. Initially all stroke admissions to both units starting three months prior to the study were reviewed; and then to obtain matched groups of adequate size, admissions more than three months earlier were included. Length of time between cerebrovascular accident and follow-up date ranged from 3 to 6 months.

Patient selection was designed to identify post cerebrovascular accident patients

with moderately severe acute residua who survived. Criteria for inclusion in the study, therefore included presence of hemiplegia secondary to cerebrovascular disease. Criteria for exclusion included previous ambulation limitations, independent ambulation within two weeks of cerebrovascular accident.

The treatment intervention consisted of an intensive 3 months patient physical therapy program. Patients receiving treatment were divided into two program with 15 individuals in each approach. In the program, patients received 30–45 min of physical therapy, 4 days/week, for a duration of 8 weeks. All physical therapy interventions were performed by registered physical therapist, An initial assessment by a physical therapist, and followed by a team meeting defined the necessary interventions, which oriented toward functional tasks such as transfers, walking, self care, and feeding. Approach modalities include strengthening, stretching, mobilization, muscle reeducation.

The evaluation consisted of the Motor Assessment Scale (MAS) and Modified Barthel Index (MBI). The treatment approach consisted of Neuromuscular Development Treatment (NDT) and Neuromuscular Balance Approach (SOS)

Prior to contacting patients for follow-up, the two patient groups were matched according to several parameters. Average

age, premorbid medical risk factors and initial self-care status were compared by paired t tests. None of these parameters exhibited a significant difference between the groups.

In addition, side of hemiplegia and sex differences were compared by chi square analysis. No significant difference in number of right and left hemiplegia in the two groups was found. However, there were significantly more females in the SOS than in the NDT program ($P=.05$). This difference was believed not to be clinically significant in relation to study objectives, so no further cases were excluded, thus maintaining the maximum possible sample size.

After matching, 15 patients from the SOS and 15 from the NDT program were included in the study. Patients then completed a functional scale score regarding current functional status. SOS patients were contacted by a SOS physical therapist, while NDT patients were contacted by NDT physical therapist.

The functional items reflect the same skills as those measured in the initial occupational therapy evaluation, as well as ambulation skills and a more general assessment of upper extremity function. To permit direct comparisons of initial versus outcome functional abilities of daily living status, patients were asked to rate each skill on a one to six and one to

three scale equivalent to that initially used by the physical therapist. patients were also asked about functional ambulation capability on the same one to four scale. As an overall functional measure, a self-care score was calculated for each patient in the same manner as for the initial occupational therapy evaluations. The mean change in self-care score was then compared as a measure of overall effectiveness of the rehabilitation program. Final "overall ambulation" status is the arithmetic mean of scores in the ambulation section of the questionnaire. Interrater reliability and response consistency was tested by having a physical therapist contact five patients. Interrater reliability was calculated on both self-care and ambulation items. Correlation across 9 items for each of five patients yielded $r=0.95(P<.0001)$. This high statis-

tical correlation was felt to validate both reproducibility of patient responses. It was felt that family reporting bias would be equal for both groups.

RESULTS

Means and standard deviations of responses on each functional item of MBI are summarized in table 2. When skill levels were analyzed with a pairs t-test, there was a significant difference only in self-feeding.

MAS are summarized in table 3, there was a significant difference in supine to sidelying and balanced sitting items.

During analyses, it was noted that number of days from cerebrovascular accident to physical therapy room was significantly different in the two groups. Therefore, patients who entered rehabilitation within

Table 2. Comparison of Outcome Ratings of Motor Assessment Scale

Skill	SOS (n=15)		NDT(n=15)		Statistical Difference	
	meam	SD	mean	SD	t	P
supine to sidelying	1.2	0.30	1.52	1.02	2.25	.05
supine to sitting over side of bed	1.24	0.98	1.65	1.2	0.74	NS
Balance sitting	1.56	1.38	2.88	1.88	2.45	.05
Sitting to standing	1.84	1.31	2.32	1.52	1.20	NS
Walking	1.75	.71	2.14	2.73	-.37	NS
Upper arm function	1.75	1.28	1.71	1.11	.06	NS
Hand movement	1.8	1.23	2.26	1.43	1.08	NS
Advanced hand activities	1.89	1.41	2.58	1.58	1.38	NS
General tonus	1.75	1.28	.59	1.58	1.41	NS

Table 3. Comparison of Outcome Ratings of Modified Barthel Index

Skill	SOS (n=15)		NDT(n=15)		Statistical Difference	
	mean	SD	mean	SD	t	P
Feeding	1.20	.45	2.20	.84	2.36	.05
Bathing	.60	1.29	1.24	1.48	1.63	NS
Personal toilet	1.60	.55	2.33	1.37	1.20	NS
Dressing	2.11	1.70	2.27	2.01	.19	NS
Bowel control	1.91	2.26	2.63	1.91	.74	NS
Bladder control	1.60	1.34	2.67	1.37	1.30	NS
Toilet transfer	2.60	1.67	2.83	1.84	.22	NS
Chair/Bed transfer	1.80	1.30	1.60	.55	-.32	NS
Ambulation	1.40	1.14	2.20	1.79	.84	NS
Stair climbing	1.60	.55	3.20	3.19	-1.10	NS

* t-value represent t-test for statistical significance between means

30 days of their cerebrovascular accident were selected as a subgroup (n=7 in SOS, n=6 in NDT) and skill levels re-analyzed. Matching of these subgroups revealed, as with the smaller sample, no significant differences in age, side of hemipareses, medical risk factors or initial self-care scores.

Also, as in the smaller sample, the SOS group contained significantly more females than the NDT group (P=.05).

As with the total sample, outcome measures in the two programs for patients entering within 30 days exhibited no significant differences between groups. The significant difference in feeding outcome in the total sample was not present in the subsample.

As a further outcome measure, average

lengths of stay for each group were analyzed. NDT patients spent significantly longer on the rehabilitation ward than SOS patients.

DISCUSSION

Cerebrovascular disease is a major cause of cognitive and physical impairment in the elderly (Barnes & Raskind, 1981; Tatemichi et al, 1994). Stroke survivors often face a long physical therapy process to regain a normal or near normal life (Calvanto et al, 1993). physical therapist must assess the probable outcome of their patients physical therapy programs. consequently, their ability to accurately estimate a patient's level of independence at the end of a physical therapy program

and to specify the patient's needs is extremely important(Dejong & Branch, 1982; Shah et al,1991).

Our finding that use of an intensive neuromuscular reeducation approach to stroke rehabilitation did not influence longterm functional status is in agreement with previous studies(Logigian et al, 1983; Quin, 1971; Stern et al,1970). Prior investigators found that addition of NDT to a SOS program did not result in greater improvement in motility or functional status in stroke patients. Our slightly superior outcome in self-feeding among patients receiving SOS did not represent a clinically significant difference between groups. In both groups patients were largely able to feed themselves, but required small amounts of help.

This study differed from previous studies in two respects. First, this study evaluated both upper and lower extremity functions in patient groups large enough for statistical analysis, Second, this study evaluates physical therapy outcome as long-term function within a home environment. All previous studies have considered "physical therapy outcome" at time of discharge, which ignores the all-important question of skill carryover postdischarge.

Several study design items deserve comment. Initial matching was performed to assure that differential outcomes rep-

resented intervention effects rather than differences in initial patient groups. however, accurate early predictors of ultimate post-cerebrovascular accident functional ability have not been identified, although a number of investigator(Bobath, 1959; Feigenson et al, 1997; Logigian, et al, 1983) have identified prognostic "clusters." Items selected for initial matching were selected retrospectively, uniform medical and neurologic information was not available.

Therefore, only the number of medical risk factor score. This may have introduced an observation bias into the matching procedure. The initial self-care score was taken from each patients initial physical therapy evaluation form. It reflects overall severrity of neurologic insult and has been identified as a significant stroke outcome indicator(Britton et al, 1980; Feigenson et al, 1997; Logigian et al, 1983).

One major finding was the significantly different interval between hemiplegia and admission to the physical therapy room. This difference represented a problem because several studies have identified prolonged hemiplegia to physical therapy interval as a negative factor in functional outcome(Anderson et al, 1974; Boureston, 1967; Feigenson et al, 1997; Novack et al, 1984). In all of these studies, however, it was found that hemiplegia to physical

therapy interval was a contributing variable only when considered along with other prognostic factor. Furthermore, interval presumed to cause significant outcome differences ranged from one month to several years(Feigenson et al, 1997; Novack et al, 1984). To test the effect of prolonged hemiplegia to physical therapy interval in our study, a subgroup consisting only of patients who were admitted to physical therapy within two months of their cerebrovascular accident was selected. Initial matching cartegory were evaluated on this subgroop and the two experimental groups were again found to be appropriately matched. When subgroup outcome dada were compared, no significant differences in outcome were identified.

In analysis of outcome information, it was found that SOS patients had significantly longer lengths of stay than NDT.

There are several possible explanations. first, Neuromuscular developmental treatment is a slower process. second, outpatient service were less available to the NDT, thus requiring longer hospitalization to fully optimize functional status.

There has been recent interest in the concept of brain plasticity. It has been demonstrated in animal model that the central nervous system can respond to neural damage with collateral sprouting of the remaining intact nervous in the

fringe zones(Wall, 1980).

The neurophysiology of recovery after stroke is often attributed to the revolution of local factors such as resorption of edema and necrotic tissue and the development of adequate collateral circulation to the surrounding area of ischemia(Dombovy & Bachyrita, 1988). There is suggestive evidence that physiologic function and behavioral evidence of recovery after brain damage may depend on repetitive functional demand or training in specific activities(Bachyrita & Balliet, 1986; Chow & Steward, 1972).

Another aspect of hemiplegic patients physical therapy is the quality of life of the hemiplegic survivor. There have been several studies that have documented a deterioration in the perceived quality of life after a stroke(Achisio et al, 1984; Siliman et al, 1987).

In conclusion, a controversy exists in respect to the value of physical therapy services in the hemiplegic patients. This study suggests that therapeutic interventions can be translated into increased functional gains that are clinically relevant. The gains were primarily in the area of feeding in Modified Barthel Index and supine to sideling and balance sitting in Motor Assessment Scale. The improvements had a significant effect for many individuals who are now independent in tasks.

CONCLUSION

The present analysis shows that the MAS and NBI assess different factors and that they represent a continuity of functional abilities levels. The sensitivity of studies of stroke and stroke physical therapy outcome can be enhanced through the use of a functional abilities score obtained. The results obtained in this study warrant further examination of the effect of clinical improvement with different therapeutic intervention in the group of subjects after stroke, selected according to site and nature of the lesion. More in depth knowledge may be acquired about the distribution of motor control patterns with respect to the degree of neurologic deficit for the enhancement of residual motor control function in hemiplegia.

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