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The EFFECT of HAND-SPLINT for 2 CASES

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두 사례에 의한 수부 스프린트 효과

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Introduction

Our hands have very important functions in our daily life. By hands, we can make a relation with ourselves, other people, and an object. We do leisure activities, self-maintenance, and etc...(Exner, 1996) with our hands. But if we get injured or get a disease accidentally, the functions of our hands decrease, causing serious problems in our daily life. main functions of our hands are to grasp and pinch. In order to accomplish these functions, the organization of hands which consists of small muscles must work together.

Generally, when we grasp an object, from the anatomical perspective, the web space of our hands has to make space for the hands to grasp an object, and our thumbs have to be 30-40 abduction and flexion. When all these functions do their part properly, our hands can grasp and pinch an object (fess,1996).

One of the most dangerous injuries that makes those living muscles dead is "burn." This type of injury can cause the dorsal, lumbrical muscles of our hands that participate in grasping to shrink, so most of people who got burned can't grasp.

For many Hemiplegic and cerebral palsy patients, there

are various treatments such as Brunnstom or Bobath, which cannot make injured hands recover completely. In these treatments,patients are encouraged to keep trying to move their hands. Though all 10 fingers are able to move independently, specially the thumb and the second finger, sometimes patients can't handle or grasp an object due to the disturbance of spasticity(Brunnstom, Bobath). in order for Hemiplegic patient to improve functions of upper extremity, splint is applied to protect wrist joint and to decrease spasticity.

A splint is used for various purposes according to patient's conditions. For example, it protects weak muscles in convalescence, a joint, and a nerve, in order to prevent secondary injuries such as shortening or conjunction of joints from external impact.

Also, a splint corrects the deformity of a joint, substitutes palsy or weakened muscles, and protect palsy muscles, weak muscles in recovery, ligaments, tendons and nerves. so it expedites the healing process. Manufacturing a splint according to the various purposes is a very important part of Rehabilitation(손은교, 2000).

In manufacturing a splint, there are two apporaches: biomechanic and sensoymotor. The biomechanic approach is related to kinetics and electric generation that occurs in body, and in the sensorymotor approach, based on biomechanic approach, the main theoretical frame is involved with controling or facilitating damaged central nerve system for normal movements . Therefore, a splint, based on all these theories, should be designed to meet the various conditions of a patient.

Generally, hospitals supply diverse types of splints to patients, but there were not many studies on their effect. To cope with this situation, I would like to make a detailed investigation of the effects of a splint in the occupational therapy field by comparing different range of motion (ROM) of joints before and after using splint.

In order to do so, I used three evaluation tools: Jebsen-hand test to estimate function ofhands, Total Passive Motion(TPM) to measure range of motion, and Canadian Occupational Performance Measure (COPM) to test satisfaction.

STUDY METHOD

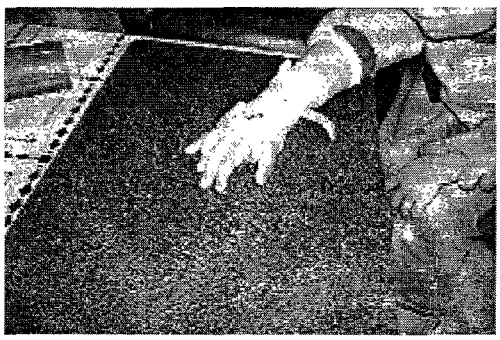
1. Subjects and Period of Study

Two patients in this study had been treated at Department of Rehabilitation in Cheju-Hanmaum Hospital(Case1 and 2) and one burned patient at Hangag-Sungshim hospital in seoul(Case 3).

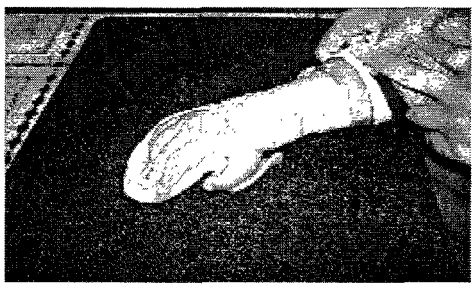
This survey was conducted from June, 2001 to November, 2001

Case 1.

A patient in Case 1 is cerebralpalsy (4 years old). The patient has problem with grasping and pinching with one hand, which is hemi- type. I had indicated two big problems with upper extremity functions in other 'cerebral palsy' cases. One is muscle tone that disturbs a independent movement of grasp and pinch; the other is the stiffness of a joint. Therefore, in order to reduce the muscle tone of a hand, I used two kinds of splint(picture1) (picture 2).



picture 1- splint(1)

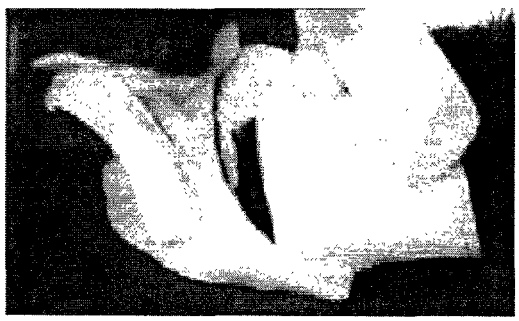


picture 2- anti-spastic splint(2)

During the day, I used picture 1; during the night, I used a anti-spastic hand splint six hours per day(picture 2).

Case 2.

The second case patient is a 56-year old male.He has a problems in M.P joint & I.P joint due to the electric-burn on his left hand. (April, 2001)



picture 3- splint (3)

He was applied with a specifically devised splint with M. P joint 90° flexion(all fingers); I.P joint 90° flexion (4~5th fingers), and (1-3rd finger) extension. While he has the hand splint, he was provided with O. T every day.

2. Method and Tool of Evaluation

In this study, I used Jebsen Hand Function to evaluate patient's hand function. The evaluation tool wasstandardized with seven subtests that have items used in daily life.The items involves writing, card turning, simulated feeding, stacking checkers, removing large and light objects, and removing large and heavy objects. The evaluation is indicated by the second.

In order to compare the difference between before and afterusing a splint in this test. I checked the change once a month.

Also in order to test range of motionI used TPM (Total passive Motion).

In the Canadian Occupational Performance Measure(COPM), the patient himself checked his own problems and determine thepriority in their problems. It made possible to find out patient's performance and

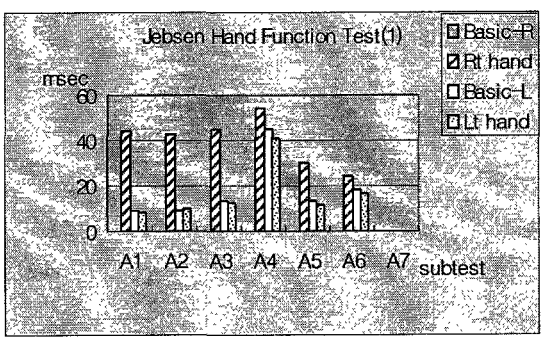
satisfaction. Tested by two professional occupation therapists,the test was 0.95 in confidence.

Results

1. The findings of Case 1:

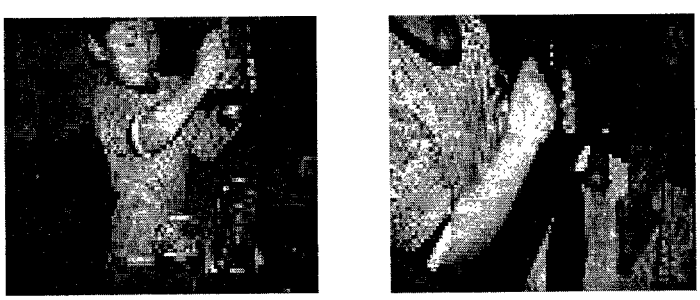
Jebsen-hand function test was given to a patient. The score of his sound hand was compared to the standard score of normal children; the score of his affected hand was compared to the score of the basic line that was tested before the use of asplint(Figure 1).

As a result, the affected hand was able to perform the movement of removimg small and light objects(44.15), removing large and heavy objects(42.66), stacking checker(44.63), simulated feeding(54.47). On the other hand, the performance of the sound-hand was lower than the performance of normal children's left non-dominant hands as it was found in Lee(1996). (In the beginning of testing the activities, the affected hand was assisted as it was before the use of splint.)



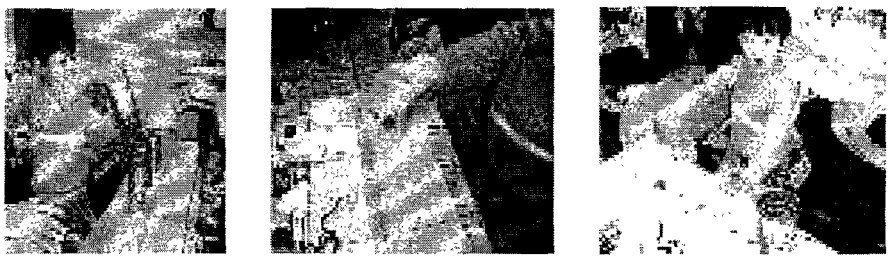
A1: Large light objects
A2: Large heavy objects
A3: Stacking checker
A4: Simulated feeding
A5: Small object
A6: Cards
A7: Writing

Figure. 1 Jebsen hand function test of C.P patient



(1) (2)

Before of splint(picture 1, 2)



(3) (4) (5)

After of splint(picture 3, 4, 5)

2. The findings of Case 2:

There was some changes in Jebsen-hand function test and ROM, as we see in the (Figure 2) the basic line and measure 1 indicate the ROM before the use of a splint, and the measure 2and measure 3 indicate the ROM after the use of a splint. The ROM of wrist joint has been improved from 45。 to 55。 and the ROM of all other joints have improved from 0。 ~15。 to 20。 ~50。 after the splint. Especially, the 3rd and the 4th of M.P joint showed the greatest improvement (50。).

The Figure 3 demonstrates the results of the Jebsen-hand test. As it shows, the performance time of all the activities except writing has shortened compared to that of the basic line.

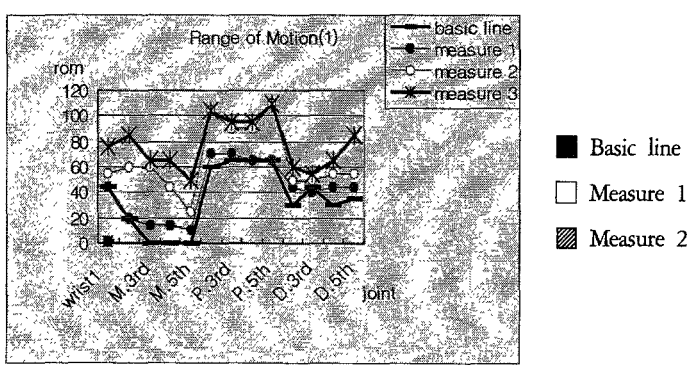


Figure 2.Change of ROM forburn(1)

* Measure 1.(before the use of splint)
* Measure 2. 3.(after the use of splint)

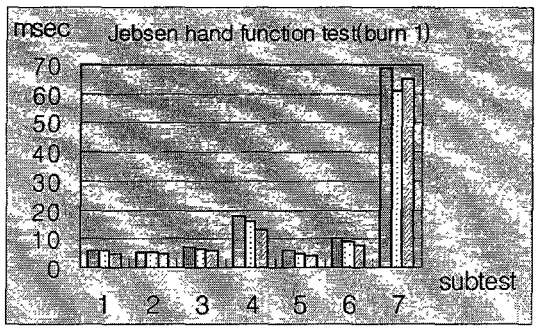


Figure 3. Jebsen hand function test of burn(1)

A1: Large light objects

* Measure 2. 3.(after the use of splint)

A2: Large heavy objects A5: Small object

A3: Stacking checker A6: Cards

A4: Simulated feeding A7: Writing

3. The changes in the level performance and satisfaction of two cases

Table 2 demonstrates the self-evaluated performance levels and satisfaction levels in the three cases. In Case 1, the child with C.P. scored the highest in performance (3.33) as well as in satisfaction(3.66), followed by Case 2.

Table 1. COPM of patient (C.P)

problems	Importent	1 session		2 session		Follow-up	
		performance	satisfaction	performance	satisfaction	performance	satisfaction
1. Forward resuch of hand	6	1	1	4	5	8	7
2. Activity of both hand	6	3	3	6	6	7	7
3. stiffness	10	1	1	5	5	6	6

Performance Score 1 = 5/3 =1.6 * Satisfaction Score 1 = 5/3=1.6

Performance Score 2 = 15/3=5.0 * Satisfaction Score 2 = 16/3=5.3

Follow-up = 21/3=7.0 * Follow-up= 20/3=6.6

Table 2 . COPMoftwo patients

	Performance		satisfaction		Change follow	
					performance	satisfaction
Case 1	1.6	5.0	1.6	5.3	3.4	3.7
Case 2	3.0	5.0	2.5	4.0	2.0	1.5

Discussion

1. Discussion related to the results of this study

As seen in existing literature (Brunstrom and Bobath), as a result of impaired function of upper extremity, children with C.P have problems with muscle tone and extension which enable grabbing and holdingIn order to minimize these problems, two kinds of splint were applied in this study. As a result, the test was possible with minimum assistance for starting-movement of removing large light objects, removing large heavy objects and stacking checkers.

Even thought it was not be able to measured, some improvement of quality were found. For example, the frequency of trying to reach and hold objects has increased in the affected hand. This was supported by the higher scores of the cerebral palsy patient (Case 1) in perceived performance level and satisfaction compared to that of the burn patients (Case 2).

Although, Case 2, the results can vary according to the condition and degree of impairment of the patient. In this study, although it was difficult to obtain burn patients with identical conditions, both patients had impaired their left dorsal hand with limited range of motion in M.P joint and I.P joint. They have been on occupational therapy for a month.

2. Discussion related the method of this study

Jebsen Hand Function which used in this study is devised by Jebsen in 1969, and it is consist of seven objectified and standardized subtest.

This evaluation tool able us to measure hand function which is various and wide using in daily life to standard unit.

There aren't many evaluation tools to evaluate function of hand, and Jebsen Hand Function is one of them. It is standardized and easy to use and requiring little time. inspection confidence is 0.99. Jebsen said, this evaluation tool can measure hand disability and evaluate the improvement of hand function during treatment. But, This evaluation tool can't measure quality of prehension and only evaluated speed of various hand activity individually.

Also it doesn't have evaluation of hook and power that measures coordination of both hands. With this method of inspection, Jebsen measured each subtest's time required and started to standardized inspection to adult in 1969. And He reported, according to dominant hand and sex, it shows differences. Standardized inspection of children in 6-19 years old is standardized by Taylor in 1973. In our country(Korea), we standardized Kim

Yuen-Hee(1984) as adult and Kim Byung-Hee(1987) as child. Also compared normal child's function of both hands with Lee Sung-Ah(1996), who is sound hand of hemiplegia patient. The result showed little differences at infinitesimal movements and writings. In this study, we used same method of evaluation between burned patient and cerebralpalsy patient.

Basically, splint canbe devide into static splint and dynamic-hand splint. Static splint

is used in fixing the joint. and dynamic-hand splint is for movement of joint except fixed joint.The purpose of splint is to make inflammation at least and recovery of joint, protect injury, and to accelerate the normal range of motion. The case of inflammation, it can endure some level of power, but if wearing splint too early after injury, it aggravates inflammation and causes curtailment of range of motion. Soft tissue is strong at prolonged stress. The anti-spasticity splint that used in this study is good to stiffness palsy patient. The anti-spasticity splint is appropriate for cerebral palsy patient or head injury by external injury patient who often occurs stiffness(손은교, 2000). Therefore, in this test, to decrease stiffness that occurs to upper limbs of cerebral palsy and to prevent transformation of joint, weared picture 2 at night, and picture 1 during the day.

3. Limitation of Study

Admittedly, there were the some weak points in this study. First,it was hard to generalize the results that have been obtained from the limited number of the subjects.Secondly, it was also hard to compare the efficiency of splint exactly because the conditions of patient's injury were not the same. Third, there was not enough medical data of the subjects which otherwise might have affected my interpretation of the results. For example, E.M.G. must have checkedto see whether there was a damage in the nerves of burned patient. But because of lack of medical facilities and the patient's cooperation, I could not do it.

Fourth, the inspection of Cerebral palsy patient showed thatthere was a big improvement for grasping movement after using splint. But it was hard to measure.

Fifth, the patients checked the time of wearing splint themselves, so the result may not be accurate. Lastly, there was not sufficient communication among occupation therapists,patients, anddoctors. That is, in order to get more accurate results, the patients and the doctors in charge should know enough about the purpose and direction of this study. It seems to require cooperation in every little step to provide a better medical service. If we consider the weak points mentioned above, we can obtain more accurate information about the efficiency of the splint in treatment of affected hands.

Conclusions

The result of this study is as follows :

1. In case of the cerebral palsy patient, after applying a splint, there was a quality change in hand spasticity and wrist joint stiffness.Jabsen-hand Test was initially impossible, but five months after applying a splint, it became possible only with the assistance of start-activity. That is, the performances of the affected hand has progressed, such as removing large and light objects (44.15), removing large and heavy objects (42.66), stacking checkers (44.63), and simulated feeding (54.47).

2. The patient with a electric-burn hand initially was not capable to grip properly, but after treatment, grasping power has increased from 2 Kg to 10 Kg, and after two months, range of motion (ROM) of M.P. joint has significantly increased by 20 degrees, especially 4th and 5th M.P. joint by 50 degrees. In the Jebsen-hand test, there was only a change of performance time in stacking checker and simulated feeding.

3. The result of Canadian Occupation Performance Measure (COPM) showed that the cerebral palsy patient showed the biggest change among three patientsin performance and contentment.

I found out that a splint helps to decrease spasticity and improve ROM of hand. In conclusion, applying splints can improve the functional activities of affected hands.

References

Bobath K. Neurophysiological Basic for the Treatment of Cerebral Palsy.J.B.LippincottCo,1980

Brown JK, Rensburg F, Walsy G, et al. A neurological study of hand function of hemiplegic children. Dev Med Child Neurol 1984; 29:287-304

Canadian Association of Occupational Therapists. Enabling occupation : An occupational therapy perspective. Ottawa, ON : CAOT publications ACE. 1997

Exner CE. Development of hand skills. In Case-Smith J, Allen AS, Pratt PN. Occupational Therapy for children. 3rd ed. Mosby Co, St. Louis, 1996; pp. 268-306,

Fess EE. Force manitude of commercial spring-coil and spring-wire splint designedto extend the proximal interphalangeal joint. J Hand Ther. 1988; 1:186

Fess EE. Gettle KS, Strickland JW. Hand splint; Principles and methods. Mosby,StLouise, 1981

Jebsen RH, Taylor N, Trieschman RB, Trotter MJ, Howard LA; An objective andstandardized test of hand function. Arch Phys Med Rehab 1959; 50:311-319

Taylor N, Sand PL, Jebsen RH. Evaluation of hand function in children. Arch PhysMed Rehabil 1973; 54:129-135

김병희, 장철민, 김연희,등.Jebsen Hand Function Test에 의한 정상한국 소아의 손기능평가. 대한재활의학회지 1987; 11(1):102-106

김연희, 최미숙, 김봉옥.Jebsen Hand Function Test에 의한 정상한국 성인의 손기능 평 가. 대한재활의학회지 1984; 8(2):109-114

손은교. 스플린트-제작원리와 적용 2001; 정담출판사:19-181

이성아, 박창일, 김유철, 등. 편마비 아동의 건측 손기능과 정상아동의 양손기능비교. 대한작업치료협회지 1996; 1:11-19

Hand-Splint의 효과에 대한 기초조사 (잡기능력에 장애가 있는 2 사례를 중심으로)

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<초 록>

본 연구의 목적은 손 기능에 문제가 있는 환자들을 중심으로 splint의 효과를 알아보기 위한 기초조사로써 2명의 환자를 제주 한마음병원(Case1, 2)에서 2001년 6월부터 11월까지 조사하였다. 2명의 환자는 다음과 같다.

i) 사례 1 : 뇌성마비 아동(4세, 남, 오른손)으로 한쪽 손목과 엄지손가락에 강직으로 인하여 잡기 기능에 제한이 있는 편마비 아동이다.

ii) 사례 2 : 전기화상(56세, 남, 왼손)으로4-5번째 손가락의 M.P joint와 I.P joint에 관절운동 제한으로 완전하게 주먹을 질 수가 없다.

연구를 위하여 손 기능의 평가는 표준화가 되어있는 Jebsen-hand function test, Total passive Motion(TPM)을 사용하였으며, 환자들의 만족도를 알아보기 위해서는 Canadian Occupational Performance Measure(COPM)을 사용하였다.

i) 사례 1 : 두 가지 splint를 적용하였다. 즉 낮 동안에는 splint 1, 밤 동안에는 splint 2를 6시간 이상 착용하도록 하였으며 작업치료는 시행하지 않았다.

ii) 사례 2 : 이 환자에게는 작업치료가 끝나는 동시에 splint. 3을 6시간 이상 착용하도록 하였으며, M.P joint와 I.P joint의 관절 변화를 조절하도록 특별히 고안된 splint를 적용하였다.

그 결과 사례 1의 Jebsen-hand function test시 초기에는 측정을 할 수가 없었으나, splint착용 후 크고 가벼운 물건 옮기기(44.15), 크고 무거운 물건 옮기기(42.66), 적목쌓기(44.63), 먹기 흉내내기(54.47) 등에서 처음 동작만 도와주면 측정이 가능할 수 있도록 진전을 보였다(그래프1), 사진(착용 전과 착용 후). 사례 2의 경우 Jebsen-hand function test의 적목쌓기와 먹기 흉내기가 가장 높았으며, 글씨 쓰기가 가능했다. 손의 관절가동 변화에서도 splint 착용전의 측정치와 착용 후 관절 가동 범위의 변화 폭이 약 30。 차이를 보여주었다(그래프 2), (그래프3).

결론적으로 손 기능 회복에 직접적인 재활 치료뿐만 아니라, 치료 후에도 splint를 착용하여 가정에서도

계속적인 치료가 될 수 있도록 하는 것이 손의 기능회복에 도움이 됨을 알 수 있었다. 그러므로 각 환자의 문제점을 파악하여 적절한 splint를 제작해 줄 필요가 있다고 사료된다. 이 기초조사를 시작으로 하여 더 많은 환자들을 대상으로 splint가 손 기능 회복에 어떠한 영향을 미치는지 그 효과에 대하여 계속적인 연구가 필요할 것이다.