The Development of Devices for the MOTIVATIVE Exercise of Impaired Extremities

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Abstract:

The cushion, the upper extremity function training device, the simple ankle plantar flexion and knee extension and flexion training devices, the flexible leg brace, the RAKU walker and the shower chair combination Raku walker with stoppers to get over a step with the slides were developed and used. By using these devices, the movement of the functioning extremity accompanies the movement of the impaired extremity. The painless motivative exercise improves the impaired extremity with extension of the range of motion or ROM instead of the passive exercise. Disabled bedridden patients who were adapted for ROM exercise depending on own general conditions were taken out to the training room by using the wheelchair. Passive exercise on mats as ROM exercise in the training room has been never done for them. The motivative exercise reinforces the muscle force of trunk and extremities and extends gradually ROM of the knee and foot by one's own pace without pain. 59 people in 193 inpatients have acquired walking from bedridden by the rehabilitation that was based on the motivative exercise.

Keywords: bedridden, accompanied movement, acquisition of walking, painless

1. Introduction

Disabled people due to the hemiplegia caused by cerebrovascular disease and lower extremity fracture try to improve physical conditions by passive exercise of a physical therapist until today. A lot of them got the contracture and became bedridden due to the difficulty of walking because there is a limit on the human resources of physical therapists. We report the devices were developed and used, with which disabled people can be rehabilitated to the acquisition of walking from bedridden. The movement of own functioning extremity can accompany the movement of the impaired extremity with the help of the devices. We name the movement of the impaired extremity accompanied that is an exercise for the impaired extremity the MOTIVATIVE exercise. Because both of own motivation of the patients to acquire walking from bedridden and the physical therapist motivates the patients to do are important and necessarily. The rehabilitation based on the motivative exercise has been realized for disabled patients to acquire walking from bedridden. This study was enforced by the hospital director's permission.

2. Devices and Usage

The authors developed the devices shown in Fig. 1 to Fig. 6. Fig. 1 is a cushion for the positioning and prevention of bedsores and the change of physiques. It is easy to use for anyone, rich in the flexibility and also good in stability. Prevention of contracture and bedsores has been done and the bedsores have improved. Also, it helps disabled patients to keep the wheelchair sitting position, then they can do the motivative exercise. Fig. 2 is a light and convenience device for training that can be used when the upper limbs function training vessel have not been set in the training room. The device is portable and has been already used at some special nursing home for the aged and the health service facilities for the elderly for more than a year. The rehabilitation by the motivative exercise was realized by using Fig. 3 and 4. Both of them are used in the sitting posture on which both feet set. Disabled patients move Fig. 3 or 4 by both feet and legs¹⁾. The accompanied movement by Fig. 3 or 4 realized the motivative exercise. The movement

range of the extremities by using these devices is announced by Endos²⁾. Fig. 5 is used for the patients who have improved of the disturbance in gait that had been caused by the drop fold of hemiplegia, contracture of equino-varus and peroneal nerve paralysis. The benefit from the official department was carried out in 1998 so that the reality of the use will be announced at the Scientific Meeting of the Japanese Society of Prosthetics and Orthotics on November in 1999. Fig. 6 is a walker. We named this walker which has casters composed with the slide and wheels the raku walker. Because RAKU means easy and comfortable in Japanese and also this walker is easy and comfortable to use. It is not always but may be dangerous to use the usual four wheels pattern walker for the patient who can walk in the parallel bars. Because it seems to run too much and walking of patient may not follow it. It was reported that the adaptation for the patient, the adapted diseases and the predominance of the at-home use to the others depending on the report after the notification of clinical trial plan finished by Takizawas³⁾ and Nagasawas⁴⁾. The performance and the way of using were reported by Takizawa⁵⁾. And also the good influence of profit to give to the establishment and the public society were reported by Makita⁶⁾ and Takizawa⁷⁾. All the results of those reports were shown in table 1.

Fig. 1. Cushion.

Fig. 2. Training device.

Fig. 3 Pata

Knee extension and flexion training devices

Fig. 4. Koro

Fig. 4. Koro

Ankle plantar flexion exercise

Fig. 5. Flexible leg brace.

Fig. 6. Raku walker, the shower chair combination.

Table 1. the adaptation for the patient, the adapted diseases and the predominance of the at-home use for the raku walker.

3)	Adaptation for patients The parallel bars walking.	The posture of patients Keeping out of the frame.
4)	The adapted diseases A distinguishing characteristic	The postoperative patient for the femoral neck fracture and coxarthrosis, the patient for the chronic rheumatism of joints and the apoplectic ictus whose function of arms is kept. It doesn't run too much by the function of the slides` friction. The patient can walk at relieved.
5)	The advantage convenience of the use	The patients can get over the step that height is up to 2.7cm high when they do not have any lifting force in their arms.
6)	An effect	Saving labor of the care person in the Health Service Facilities for the Elderly to use.
7)	An effect	The official financial expenditure can be reduced because the independence of ADL for the postoperative femoral neck fracture patient has been realized.

3. The Method and Characteristic Points

The characteristic points of the Takizawa Method rehabilitation and the method schedule are reported and shown in table 2 according to the staging for the apoplectic ictus.

1) At the time of rehabilitation training, the patients do not feel pain and the training is painless. And also pain and strong fatigue should not be left to them. Because some chronic term patients have improved even who had been hospitalized for five years⁸⁾. So that the rehabilitation must be done with patience having the patient keep the confidence of improvement and motivation. The rehabilitation is begun as early as possible.

2) The prevention of bed sore and the contracture and deformation of the joints should be the important purpose of the rehabilitation on the bed. Functional positioning and a physique changing with Fig. 1 will be done easily. The passive exercise for ROM exercise on the bed in the hospital room will be done for the purpose of the muscle power reinforcement and ROM keeping.

3) To keep a sitting position, the getting up bed floor for the patient's back to rest must be done gradually.

4) After the bedridden patients could keep a sitting position, they can be taken out to the training room with using the wheelchair advances. By using the devices developed, the motive exercise will be done with the assistance of own functional extremity without taking pain and also with considering own condition. But ROM exercise by the passive exercise on mats is never done in the training room.

5) The devices are used for the training from the early stage of the training. The motive exercise for the reinforcement the muscle force of trunk and extremities and ROM of the knee and ankle will be extended gradually. Then standing position may become possible.

6) After the disabled patients become possible to keep the standing position, the training will be

done by using parallel bars or wall bars and both of them. The orthosis like Fig. 5 and 6 are used for compensating the irreversible function.

7) The exercise is extended and continued with observing a muscle power test, an ROM test, the general conditions and the training conditions attentively by the indication of doctors.

4. Result

There is a specialized bedridden elderly-disabled patients' hospital, for one care staff member toward four patients. There are 226 hospital beds in it. When patients were hospitalized, all of them were apraxia of gait. Only 10 people could walk at that time in 1988. At the end of 1994 training was done on 193 inpatient in the training room and at the bed. The rehabilitation was done to 127 people in the training room among them by one physical therapist and four helpers every day. The result of rehabilitation and the items of inpatients' diseases are shown in table 3, what were reported by Takizawa⁹⁾ and Kijimas¹⁰⁾.

5. Discussion

The rehabilitation method with the motivative exercise, which was named Takizawa Method, is based on the experience of Takizawa⁶⁾ who is on the physical therapist list registration number 566 in Japan. Though we will introduce the same developed devices and the method to Okamoto hospital⁴⁾ of 70 beds for inpatients from now on as the field test, it is most important that we can get the same effect without the guidance of Takizawa⁶⁾ in it. After the proof, we can say that all the people use the method of getting good therapeutic value, although she has said that she was only one who treated the patients as shown in table 3. At the same time, it is important that one acquires walking again by continuing its rehabilitation and gets the chance of doing it after the discharge from the hospital. So it is important to instruct the care persons in the easy and painless Takizawa method.

Table 2. The Takizawa Method

About the stage and the adaptation for physique position for each training devices.	Stage	Super acute/ acute	convalescence			chronic
			Early	middle	late	
	physique position	bed rest, sitting	sitting	standing	gait	Home
Developed	Fig 1	*	*	*	*	*
	Fig. 3/ 4		*	*	*	*
	Fig. 5			*	*	*
	Fig. 6				*	*
	Both Fig. 2		*	*	*	*
Market goods	Spindle band		*	*	*	*

Table 3. Result of rehabilitation

Inpatients who acquired walking		Result of rehabilitation		The items of inpatients' diseases	
Year	Numbers	Numbers	1993 1994	Numbers	1993 1994
1988	10	person walking oneself	9	cerebrovascular disease	92 143
1993	51	crutch walking	2 7	bone and articular diseases	22 63
1994	59	walker walking with raku	12 3	visceral disorder	14 74
		raku walker walking	11	dementia	9 14
		walking in the parallel bars	37 29	others	5 28
		standing position	10 15		
		apraxia of gait	33 53		

6. Conclusion

1) The devices that the authors developed and the way to use them were introduced, by which the motivative exercise was realized. 2) The rehabilitation by the motivative exercise by using the devices and the Takizawa method improved in ADL to the acquisition of walking, so that it was sufficient to expect that patients acquire walking even in the bedridden elderly hospital. 3) The characteristic points are the following: exercise is be fitted to the physical condition and the ability of the patients, patients do not feel pain during the exercise and the exercise is done in the sitting or standing position without using a mat and with using the devices in the training room. 4) Though it was predicted that 2300000 people in 5200000 disabled elderly people will be bedridden in 2025 in Japan, the fact we reported that 30% of bedridden inpatients had stood on their own feet and acquired walking shows the possibility of the daily life independence for 690000 people being due to the dissemination of the motivative exercise by the devices developed and the Takizawa method.

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