INTRODUCTION

The population ratio of old people of age 65 or more has been increasing in Japan for recent years; 20.8% in 2006, 21.5% in 2007 and 22.3% in 2008 (MIAC, 2007; MIAC, 2009). The fatal fall accidents of old aged people in public spaces are increasing, according to the aging (JFAPS, 2009). The rates of fatal fall accidents were 0.25 per 100,000 persons of age 15-44 years old, 3.3 for age 65-79 (13.2 times) and 28.5 for age 80 or more (114 times). The fall accidents lead serious ones in many cases, especially the fractures of femurs which cause to be bedridden in many cases. Therefore the preventing fall accident is one of the most important subjects for old aged persons/patients to keep their ADL: (ability of daily life) (Medsafe.net, 2009).

There are some studies about the fall accidents of old-aged persons/patients; the study of frequency of fall accidents (Yasumura, 1999), the classification of fall accidents in the senior nursing homes (Numasawa et al., 2003) and their relations to walking abilities (Furuna et al., 2006). But there are few studies about preventing fall accidents and recurrences in hospitals (Yasumura, 2009).

Old-aged patients, especially when they cannot keep stable sitting postures on wheelchairs, may get hurts seriously by falls. Preventing fall accidents is one of the most important subjects for keeping ADL of old-aged persons. We investigated the fall accidents related to from wheelchairs that occurred in a hospital (Asao General Hospital of Rehabilitation), and tried to make a new type of safety belts for old-aged wheelchair users based on the investigation. The results of trials using the product was evaluated by the care givers. The number of fall accidents in the hospital amounted to 226 cases within a year. It is noticed that the patients removed their belts by themselves intentionally or unintentionally, which is the most important point of the accidents. The evaluators of new belts were 91 care givers. The evaluation items were (1) the convenience for caregivers to fasten and remove the belts, (2) the ability of holding the patient on the wheelchair, (3) the safeness to prevent the fall from wheelchair (including the disability of removing a belt by the user), (4) the appearance when the usually used belts and the new belts were used, and only for the new belts, (5) the hygienic aspect and (6) the utility of the pocket. The new belts got better marks than the usually used belts. We intend to further improve the trial product (new belt) to be safer, more effective and more comfortable, based on the evaluation.

Key words: restriction belt; wheelchair user; fall accidents; dementia

A TRIAL PRODUCT OF A NEW SAFETY BELT FOR A WHEELCHAIR USER AND ITS EVALUATION BASED ON THE ACTUAL INVESTIGATION OF FALL ACCIDENTS RELATED TO WHEELCHAIRS IN A HOSPITAL

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Old-aged patients, especially when they cannot keep stable sitting postures on wheelchairs, may get hurts seriously by falls. Preventing fall accidents is one of the most important subjects for keeping ADL of old-aged persons. We investigated the fall accidents related to from wheelchairs that occurred in a hospital (Asao General Hospital of Rehabilitation), and tried to make a new type of safety belts for old-aged wheelchair users based on the investigation. The results of trials using the product was evaluated by the care givers. The number of fall accidents in the hospital amounted to 226 cases within a year. It is noticed that the patients removed their belts by themselves intentionally or unintentionally, which is the most important point of the accidents. The evaluators of new belts were 91 care givers. The evaluation items were (1) the convenience for caregivers to fasten and remove the belts, (2) the ability of holding the patient on the wheelchair, (3) the safeness to prevent the fall from wheelchair (including the disability of removing a belt by the user), (4) the appearance when the usually used belts and the new belts were used, and only for the new belts, (5) the hygienic aspect and (6) the utility of the pocket. The new belts got better marks than the usually used belts. We intend to further improve the trial product (new belt) to be safer, more effective and more comfortable, based on the evaluation.

Key words: restriction belt; wheelchair user; fall accidents; dementia
falls. It is said that the same patient returns to the hospital by the same reason, but the actual and
detail information is not yet obtained.

The present authors intended to investigate the actual data of fall accidents related to wheel-
chairs that occurred in a hospital (Asao General Hospital of Rehabilitation), to which three of the
authors are belonging, and tried to make a new type of safety belt for old-aged wheelchair users
based on the investigation. The trial product was evaluated by the caregivers. The subjects were the
old-aged patients using wheelchairs in the hospital, who usually used the restriction belts for prevent-
ing falls. We intended to improve the trial product (new belt) to be safer, more effective and more
comfortable, based on the evaluation.

INVESTIGATION OF ACTUAL FALL ACCIDENTS FROM WHEELCHAIRS
IN ASAO GENERAL HOSPITAL OF REHABILITATION

The number of accidents amounted to 226 cases during a period from April in 2008 to March in
2009. Three cases of them were fractures and one case was treated by caused the operation and
transferred to another hospital. Most of the patients were in the department of brain surgery, and the
others were in the departments of orthopedics and internal medicine. It was noticed that the patients
with dementia, higher brain dysfunction and/or psychosis were repeatedly admitted to the hospital.
The accidents occurred at sickrooms (141 cases), corridors (42), toilets (25), bathrooms (7), rehabili-
tation rooms (6) and others (5). The motives were the transfer from beds to wheelchairs, dangerous
behaviours due to over-confidence to own fitness and unclear reasons. Although the arrangements
were considered after each accident, they repeatedly occurred.

We investigated the actual fall accidents of wheelchair inpatients with usually-used restriction
belts in the hospital (that is, sex, age, department, days in hospital, HDS-R: Hasegawa dementia scale
of revised version, date and time of the accidents) (Hasegawa, 2004). The wheelchair users were 24
inpatients (8 males and 16 females), 15 patients of which (62.5%) were over 65 years old. The acci-
dents occurred from April in 2008 to March in 2009. The details of the results are listed in Table 1.
The subjects and/or their families agreed with our investigation and publication.

Table 1 shows that the accidents that occurred from spring (March to May) to summer (June to
August) in many females, and from autumn (September to November) to winter (December to
February) in many males. But each occurrence was accidental, because there was no particular rea-
son. The temperature and humidity were always kept constant in the hospital, so no tendency accord-
ing to the season was found. Nineteen of the 24 patients (79.2%) were in the department of brain sur-
gery, four (16.7%) were in the orthopedics and one (4.2%) was in the internal medicine. They were
with dementia (18 cases), higher brain dysfunction (22 cases) and/or psychosis (8 cases). The
motives were mostly unclear: in 13 cases, they removed their restriction belts for unknown reasons
and stood up then fell, in ÇX cases, they removed their belts to transfer from wheelchairs to beds or
toilets, and in ÇQ cases they fell from the wheelchairs. It is noticed that the patients removed their
belts by themselves with or without their intention, which was the most important point of the acci-
dents.

Although there were no clear relationships between most items investigated, there was a signifi-
cant linear correlation (r=0.59, p<0.01) between the patients’ ages and accidents’ times as shown in
Figure 1; older patients tended to have such accidents later (accident time (24h)= 0.168 x  age (years)
+ 3.80). The most important result was that the accidents occurred almost every month and all
patients usually used restriction belts. This indicates, as mentioned before, that they had high possi-
bilities of accidents, leading to the decrease of their ADL and to high possibilities of accidents when
they returned to their houses.
A TRIAL PRODUCT OF A NEW TYPE OF SAFETY BELTS FOR OLD-AGED PATIENTS USING OF WHEELCHAIRS AND ITS EVALUATION

The authors intended to make a new type of safety belts for wheelchair users among old-aged patients, especially those who could not keep a stable sitting posture often with dangerous behaviours. The new belts were offered to replace the usually used restriction belts.

Concepts and actual characteristics of the new type of safety belts

The concepts and characteristics of the new type of safety belts were as follows; the most impor-
tant function was to keep the patients safely on the wheelchairs (main function), the patients could not remove the belts (safeness), easiness of fasten (lock) and remove (unlock) for caregivers (utilities for care givers), easiness of cleaning and anti-staining (hygienic aspects) and physical and mental comfort as a soft cushion with a better appearance.

Figures 2 and 3 show, the front and back views of usually used restriction belts that is consisted of an apron part (almost triangular form) and three belts derived from the corners of an apron. The caregivers tie the three belts tightly behind/beneath the wheelchairs in diverse manners. But the patients even with dementia often untie them to stand up and fall. The caregivers untie them when the patients are transferred, which takes time with the belts easily falling onto the floor to be stained. Figures 4-7 show the new safety belt that is consisted of a seat with a pocket, a belly support part (apron) and belts with a number-lock buckle. The usually used belts have the only purpose of keeping patients onto the wheelchairs, but the new belt has a seat with good cushion of sponge and has a pocket in which the apron and the belts could be put in when the patient stands up. The hardness of the seat could be controlled by changing the sponges. The patients can hardly unlock the number-lock buckles while the caregivers unlock them easily.

Fig. 2. A usually used belt (front view).
A: apron, B: Three belts from the triangular corners of the apron.

Fig. 3. A usually used belt (back view).
Three belts are tied in one knot beneath the seat, preventing the untie by the patient.
Evaluation of the new type of safety belt

The usually used restriction belts and the new belts were evaluated by 91 caregivers working in the hospital; 58 nurses (NS; including one male) and 33 medical assistants (MA; 16 females and 17 males). Their ages and working years were 39.9±8.78 (range 26-58) and 16.3±8.41 (3-31) years for NS, 36.5±9.23 (22-63) and 6.4±4.04 (1-14) years for MA, respectively. The evaluation was performed in March, 2009. The evaluators used the new type of belts for a few patients (at least two patients), after being instructed about the characteristics and the usage. Questionnaire items for both
belts included (1) the convenience to fasten and remove the belts, (2) the hold ability of the patient on the wheelchair, (3) the safeness to prevent the fall from wheelchair and (4) the appearance, and only for the new belts, (5) hygienic aspects and (6) utility of the pocket were added. The evaluation was done by a five-point scale [-2: very bad], [-1: bad], [0: neutral], [1: good] and [2: very good].

The evaluation results for both belts are shown in Figure 8. The score of (1) for usually used belts was -0.31±0.90 but 1.27±0.71 for the new belts. The score of (2) for the former was -0.11±0.68 but 0.87±0.83 for the new type. The score of (3) was 0.16±0.96 for the former and 1.25±0.81 for the new type, which changed from low to high scores. The score of (4) for the former was -1.08±0.66 but 0.84±0.90 for the new type. All these differences were statistically significant by the t-test at 99.9% of confidence level. The scores of (5) and (6) were 0.83±0.72 and 1.00±1.02, respectively. Free answers said that the cushions were hard, and the colour and patterns of the belly part and the seat were too prominent, but they fundamentally depended on the patients’ preferences and could be changed easily. These results meant that the new belts were evaluated positively.

![Fig.7. New type of safety belt (back view). Side belts are fastened behind the support of the back. The patient cannot unlock the number-lock buckle (shown N in Figure 5).](image)

**CONCLUSIONS AND DISCUSSIONS**

It is very important to recognize that a decrease in the ability to keep a stable sitting or standing posture is a common characteristic of old-aged persons. The problems in the rehabilitation for old-aged persons are that (i) they have not only the diseases but also disuse syndromes, (ii) they need longer time to be remedied and (iii) the changes of environments when they move in and out of the hospital deteriorate dementia in many cases. Old-aged patients are often weak not only in physical conditions but also in mental ones; they often change from “can do by themselves” before coming to
the hospital to “cannot do” or “can do only under training” due to disease or injuries in many cases. The inappropriate decision making due to dementia or the over-confidence about physical fitness sometimes leads to the dangerous behaviours which may cause falls among old-aged patients. The caregivers always have to check the mutual communications according to some standards (Iwasawa et al., 2007), and must enlarge ADL of the old-aged patients under these conditions. The need for safety belts which guarantee their safety is high.

The frequencies of removing the belts by patients and of fall accidents actually decreased by using the new belts. This decreased the physical and mental loads of caregivers. It is one of the most important points to make the belts or buckles inconspicuous for people other than patients, families and caregivers, so as to provide moral support. The pockets were found useful not only for preventing the staining of the belts when they dropped on the floor, but also for preventing the breakage of the lock parts when they struck against the floor or the wall. The caregivers had to sit or bend their upper bodies when they fastened or removed the usually used belts, but this was not needed for the new belts. Although the new belts obtained good marks, some points to be improved were also noted; the length of the belt was sometimes too long and caused the looseness in fastening. The shape and hardness of the sitting seat should be improved with the therapists’ advice. We intend to improve the new belts according to the advice with respect to their use for old patients with dementia and other diseases, who must use wheelchairs. We hope the new belts will be used in the same feeling as in the use of the child-seats of the cars.

REFERENCES


