

Analysis of Eye Movement of Caregiver Concerning on Transfer Operation

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Abstract. As well known, nowadays Japan is one of the several “super-ageing societies” all around the world. The aging of Japan is thought to outweigh all other nations, as the country is purported to have the highest proportion of elderly citizens; 33.0 % are above age 60, 25.9 % are aged 65 or above, 12.5 % aged 75 or above, as of Sep 2014. The increasing proportion of elderly people also had a major impact on increased burden for caregivers. Due to a shortage of expert nursing staff, training caregivers for long-term care facilities has also become a growing concern. Therefore, in order to help speed up training process, one of the popular care processes “transfer operation” between bed and wheelchair was examined. In this study, elder staff’s eye movements during transfer was measured and compared between expert, non-expert and beginner caregiver. Comparing with beginner without experience, caregivers with occupational experience were found to pay more attention on elder’s body with longer eyes rested duration according to eye movement track. Especially, expert caregiver’s skillful care process was also clarified, during which he put less time than non-expert to focus the objects such as bed, wheelchair and so on. Eye moving characteristic and difference between expert and non-expert suggested that transfer care assistance could be improved by instructing the caregivers to focus on specific parts of elder’s body effectively.

Keywords: Caregiver · Eye movement · Transfer operation

1 Introduction

As well known, nowadays Japan is one of the several “super-ageing societies” all around the world. The aging of Japan is thought to outweigh all other nations, as the country is purported to have the highest proportion of elderly citizens; 33.0 % are above age 60, 25.9 % are aged 65 or above, 12.5 % aged 75 or above, as of Sep 2014. The increasing proportion of elderly people also had a major impact on increased burden for caregivers. Due to a shortage of expert nursing staff, training caregivers for long-term care facilities has also become a growing concern.

The behavioral responses and process analysis by visual apparatus have been of increasing interest in ergonomics. Until now, eye movement/track was widely applied in ergonomic field such as process analysis. As well known, behavioral response of sensory organs can yield relevant information about performance in visual recognition tasks, in other words record eye movement track or emphasis data would reflect following whole-body movement response in some degree. Monitoring eye movements can help identify the behavior of visual focus of experts compared with non-expert, which used to detect the detail process difference or establish a standard service procedure.

During human assistant transfer operation from bed to wheelchair, there is a high risk of injury (both acute and cumulative) and fatigue loading to both elder and caregiver assistant, especially when the height differential between transfer surfaces is greater than 75 mm or the gap between surfaces is greater than 150 mm. Therefore, it is urgent and necessary to train the beginner caregiver who employed in elder nursing facilities for a long-term effectively. A significant approach to improve young caregiver's care technique and provide safe and comfortable care environment for old patient is investigating expert caregiver's manual patient handling process. Transfer operation is one of very important and frequent old patient handling processes during daily nursing care activities [1]. Therefore, in this paper, eye movement of caregiver concerning on transfer operation was focused. In this study, beginner, non-expert and expert from the same elder nursing facility were required to conduct transfer operation for elder from bed to wheel chair. During the transfer operation process, all subject's eye movement were record and analyzed. Afterwards, eye's gazing point and movement track differences of caregiver with varied experience years were verified. According to the analyzed eye movement trace, it is noted to find that expert caregiver made care eye contact with old patient through good communication before and during transfer operation. However, non-expert caregiver's eye focused on the transfer instrument but not subject patient body with bad communication process. One more important point, it is deserved to find that expert caregiver pay attention to the transfer line/route to the moving destination before and during the transfer operation with eye watching movement, which ensure the safe route for transferring process and also let old patient relieved and comfortable. Based on the eye movement results, it is concluded that expert caregiver show thoughtful care for old patient with more eye contact and keep a safe transfer line with "Omotenashi mind" during transfer operation.

2 Experiment

2.1 Subjects

Consisting with previous study, three caregivers from the same nursing home were cooperated in current study. As shown in Table 1, caregiver's information characteristics were summarized, where two caregivers had occupational experience with 154 months and 10 months respectively, named as expert and non-expert in following discussion. One more beginner caregiver without experience also employed for comparison. Here, a 'hypothesis' elder (caregiver guider) was determined for all subject caregiver's transfer tasks.

Table 1. Characteristic of investigated subjects

	Expert	Non-expert	Beginner
Gender	Male	Female	Male
Height(cm)	175	157	174
Work experience	154 months	10 months	–

2.2 Measuring Condition and Setting

Current research was conducted on-site in one of the real room in elderly nursing house. In order to record and analyze caregivers’ eye movement, “Talk Eye II” from Takei Equipment were used. Subject caregivers were required to wear the goggles over their eyes as shown. And the goggles are equipped with CCD cameras above and beside the subjects’ eyes for recording eye movement track and real gaze view field.

2.3 Predetermined Tracking Process

- A. Assisted transfer of elder from bed to wheelchair.
The caregiver entered the room with the wheelchair, approached the patient sitting on the bed, and transferred the elder o the wheelchair.
- B. Assisted transfer of the patient from wheelchair to bed.
The caregiver entered the room with the patient in the wheelchair, moved to the bed, and transferred the elder from wheelchair to the bed.

All trials of each type followed the same steps, first B-trial following with A-trial. And the trials were also carried out with the wheelchair facing the foot of the bed. Both procedures were separated into three steps and listed in following Table 2.

Table 2. Bed apparatus and transfer process

Same elder	Bed apparatus	
	Special	Normal
Subject caregiver	Expert vs. Non expert	Non-expert vs. Beginner
Process of transfer (A)		
A-1	Carry a wheelchair to bed and brake it	
A-2	Transfer assistance to wheel chair	
A-3	Place foot on the footrest	
Process of transfer (B)		
B-1	Move the requiring nursing care of the wheel chair to bed	
B-2	Brake of the wheel chair and bring one foot down from a footrest	
B-3	Transfer assistance to bed	

3 Results and Discussions

3.1 Eye Movement Track of Expert, Non-expert and Beginner

Subject caregivers' eye movement throughout transfer operation was summarized and illustrated in following black and white figures by gaze time percentage on location in sequence, which black strip represented as eye rested time percentage on corresponding location listed on left axis and white strip meant the eye focus jump to other location. As shown in Figs. 1, 2 and 3, it is obvious to find black strips nearly concentrated on objects such as assisted device, bed and floor during beginner's transfer operation, especially for long and continuous time period on floor. This phenomenon was considered as the result of without experience. Because beginner did not familiar with transfer operation process clearly so beginner always focusing on floor in order to checking a safety route during operation with nervous feeling.

As well known, both expert and non-expert have a good knowledge of transfer operation flow and steps. However, it still required to take a long-term training for non-expert to become a qualified expert. Usually even if we understand non-expert showed different performance from expert, but we did not have an evidence to prove it. Here, through comparing the expert and non-expert's eye movement, it is worthwhile to find that non-expert looked around among nearly all of elder's whole body parts with segmental time period. But expert just gazed at some parts of elder's body with continuous time and move quickly. In a word, it could be demonstrated that expert's conduct transfer operation with eye contact with elder by a longer period, but non-expert's eye movement passed through elder's body part with limited moment.

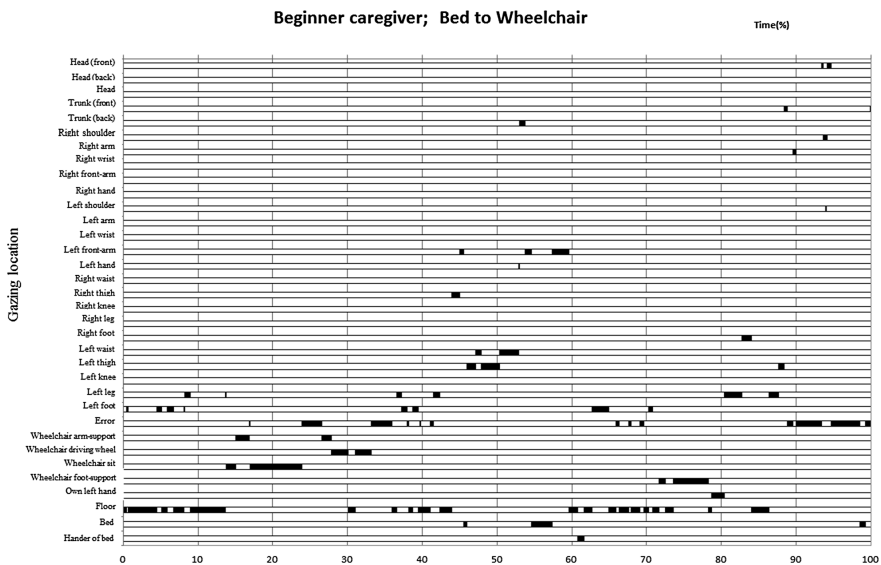


Fig. 1. Beginner caregiver's eye movement track during transfer operation from bed to wheelchair.



Fig. 2. Non-expert caregiver’s eye movement track during transfer operation from bed to wheelchair.

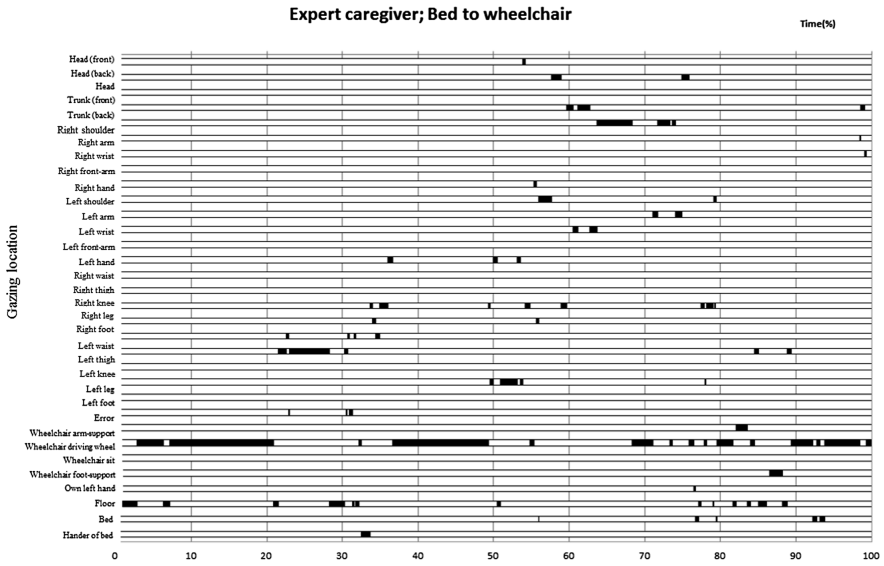


Fig. 3. Expert caregiver’s eye movement track during transfer operation from bed to wheelchair

3.2 Eye Gaze Time Percentage Comparison Among Expert, Non-expert and Beginner

Eye gaze time summary was calculated from previous eye movement process and sorted into elder’s body, wheelchair, own body, bed and floor five groups. Figures 4, 5 and 6 showed non-expert and beginner comparison during transfer operation from normal bed to wheelchair; Figs. 7, 8 and 9 displayed non-expert and expert comparison during transfer operation from special bed to wheelchair. As the same with previous eye movement track discussion, it was clearly to find beginner took a longest time focusing on floor following with effective gaze at wheelchair, left leg and left foot over 2 s. On the contrary, non-expert took more time for elder’s body than beginner with longest time gazing at elder’s trunk.

Referring to the comparison between expert and non-expert, it is notified to find that non-expert took a longer time period than expert among elder’s body, wheelchair, own body, bed and floor, which suggested that expert caregiver’s eyes moved more quickly than non-expert with focusing on some specific locations.

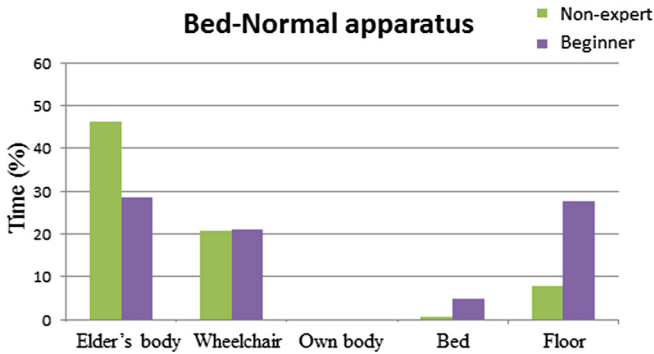


Fig. 4. Comparison of eye’s gaze location between non-expert and beginner

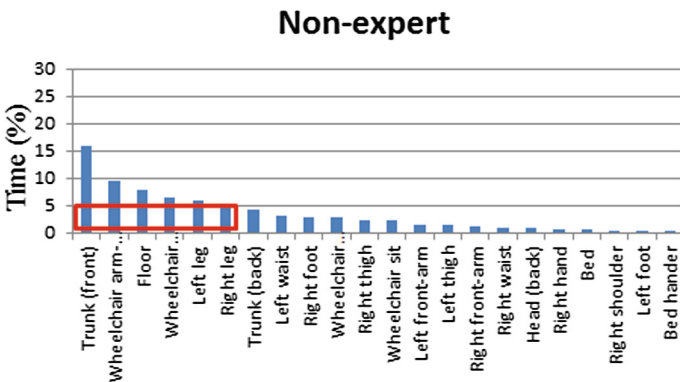


Fig. 5. Eye’s gaze time rank during non-expert transfer operation

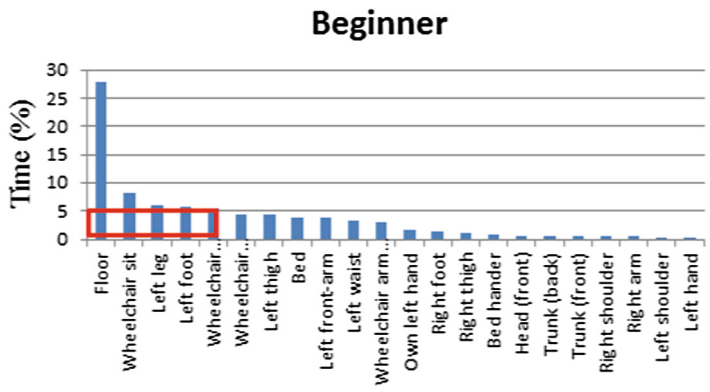


Fig. 6. Eye's gaze time rank during beginner transfer operation

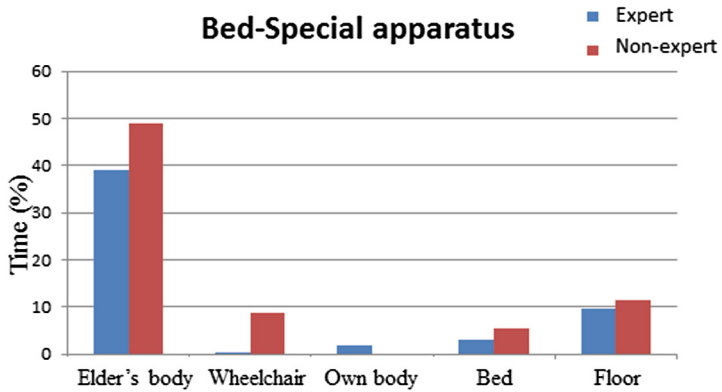


Fig. 7. Comparison of eye's gaze location between non-expert and expert

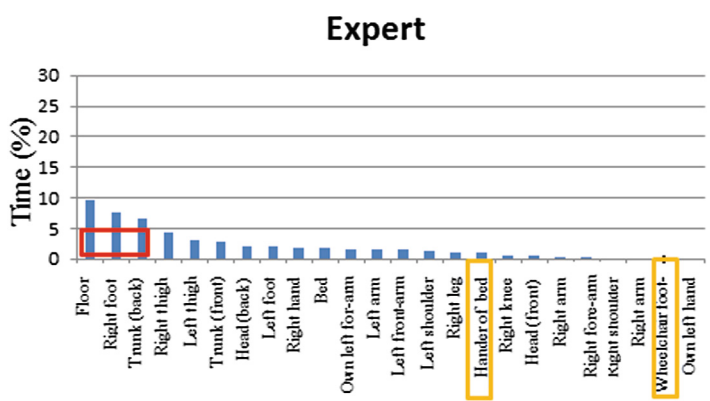


Fig. 8. Eye's gaze time rank during expert transfer operation

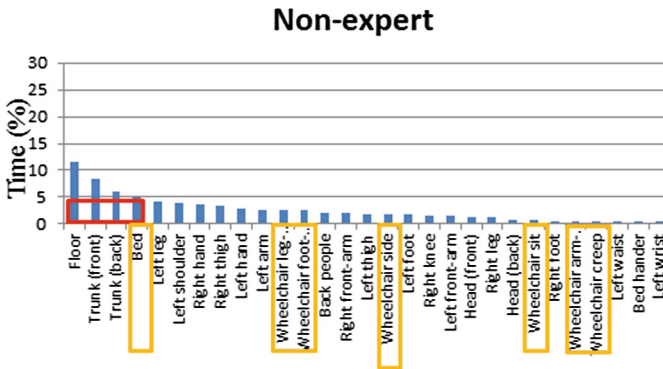


Fig. 9. Eye's gaze time rank during non-expert transfer operation

According to the eye focusing rank of expert and non-expert in Figs. 8 and 9, the experience difference was also verified, which clarified that non-expert paid more attention to assistance objects with longer eye rested period than expert.

4 Conclusions

In this research, elder caregiver's eye movements during transfer operation was measured and compared between expert, non-expert and beginner caregiver. As a result, caregivers with occupational experience were found to pay more attention on elder's body with longer eyes rested duration according to eye movement track comparing with beginner without experience. Especially, expert caregiver's skillful care process was also clarified, during which he put less time than non-expert to focus the objects such as bed, wheelchair but try to read elder's facial expressions and make related eye contact in order to release of elder's pain and uneasy. Eye moving characteristic and difference between expert and non-expert suggested that transfer care assistance could be improved by instructing the caregivers to focus on specific parts of elder's body effectively.

Reference

1. Ito, M., Endo, A., Takai, Y., Yoshikawa, T., Goto, A., Kuwahara, N.: Study on kind transfer assistance between wheelchair and bed in the case of eye movement analysis. In: Proceeding of 5th International Conference on Applied Human Factors and Ergonomics, AHFE 2014 (2014)