EVALUATION OF WALKERS FOR ELDERLY PEOPLE

T. Tamura¹, M. Sekine¹, H. Kuno¹, M. Fujie², A. Mori³, K. Andoh³
¹National Institute for Longevity Sciences
²School of Science and Engineering, Waseda University
³Geriatric Health Services, Luminous Obu

Abstract- The aim of this study was to evaluate three types of walkers for elderly people. Four elderly patients participated in the study. The experiments were performed using three walkers: a familiar conventional folding walker, a caster walker and a power-assisted walker. We evaluated walking speed, body acceleration and an electromyogram of the gastrocnemius during use of each walker. The results indicated that walkers should be selected according to the patient’s walking ability. Comparison between Power-assisted walker and parallel bar, the walking speed in power-assisted walker is higher than that in parallel bar. Power-assisted walkers are suitable for patients who are used to using a wheelchair.

Keywords - walker, elderly, walking speed, acceleration, electromyogram

I. INTRODUCTION

Walking is a basic everyday activity. In an aging society, elderly people need to walk to promote their health and independence. By retaining ambulatory independence, elderly people increase their quality of life and reduce the costs of both public health services and private health insurance. Mobility is one of the most important factors in maintaining physical and mental health.

To assist walking, several conventional types of walker are available. Different types are used for different walking abilities (see Fig. 1). The folding walker and the four-wheel walker with seat and basket are used under supervision. The folding walker consists of a folding four-legged frame with a supporting grip that the user can grasp or lean on. Wheelchairs are commonly used for elderly people who either cannot walk or can walk only with assistance and supervision. Caster walkers are used in hospitals and nursing homes. Users of caster walkers can lean on the supporting arms, and a non-weight-bearing gait is possible. However, these walkers can also be used by elderly people who have fairly good motor function.

One of the authors has recently developed a power-assisted walker for elderly people who have difficulty walking. The device consists of four wheels and a supporting pad that is held by the user. The amount of assistance provided by this walker is based on the amount of force applied. The walker moves forward, or turns, at a speed proportional to the propulsive force applied by the user. The dynamic characteristics can be easily adjusted by changing the control parameters.

Application or adaptation of these walkers is the important issue. In rehabilitation training, several walking stages are observed, and the use of a suitable walker is required to provide an improvement in the user’s quality of life. However, no physiological evaluation based on walking ability has been made of the suitability of each kind of walker for each walking stage. The aim of this study was to evaluate the physiological parameters for walkers.

II. METHODOLOGY

Six elderly people aged between 70 and 91 years (average 82±7.9 years) participated in the study. Before the experiment, written informed consent was obtained from each subject or the subject’s family.
**Title and Subtitle**  
Evaluation of Walkers for Elderly People

**Author(s)**

**Performing Organization Name(s) and Address(es)**  
National Institute for Longevity Sciences

**Sponsoring/Monitoring Agency Name(s) and Address(es)**  
US Army Research, Development & Standardization Group  
(UK) PSC 802 Box 15 FPO AE 09499-1500

**Distribution/Availability Statement**  
Approved for public release, distribution unlimited

**Supplementary Notes**  
Papers from the 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom. The original document contains color images.

**Abstract**

**Subject Terms**

**Report Classification**  
unclassified

**Classification of Abstract**  
unclassified

**Number of Pages**  
2
Gradually decreased at a closely related rate. The impact of the three types tested. Both the acceleration and the speed decreased when the subject walked with supervision. The speed of the experimental walker and the power-assisted walker were compared for four subjects who used the conventional walker, the caster walker, and the power-assisted walker.

The four subjects who could walk with supervision walked along a 10-meter straight course marked by a tape that was attached to the floor. Two position sensors were located at positions two and eight meters along the tape. The effective course was thus six meters in each direction, a total of 12 meters. The experiment was performed under the supervision of an occupational therapist. Power-assisted walkers can be used by subjects who are unable to walk without assistance. The comparison between walked with power-assisted walker and waked in parallel bar shows higher speed, but a lower vertical acceleration and smaller lateral and antero-posterior accelerations in power-assisted walker.

III. RESULTS

Fig. 2 shows the speed, acceleration and integrated electromyogram for the conventional walker, the caster walker, and the power-assisted walker. For four subjects who could walk with supervision. The speed of the experimental power-assisted walker was 0.4 meters per second, the slowest of the three types tested. Both the acceleration and the speed gradually decreased at a closely related rate. Impact acceleration is increased at high speed. The integrated electromyograms show gradual decreases as the speed decreases.

The comparison between walked with power-assisted walker and waked in parallel bar shows higher speed, large vertical acceleration and small lateral and antero-posterior accelerations in power-assisted walker.

IV. DISCUSSION

Three types of walker were compared with respect to speed, acceleration, and surface electromyogram. The speed is proportional to the rms acceleration. The speed obtained using the conventional walker was the fastest of the three types tested. The subjects of this study could walk with supervision and so have relatively good motor function. In such cases, power-assisted walkers or caster walkers are not suitable. Power-assisted walkers can be used by subjects who need assistance to walk. We observed that the two subjects who could walk with assistance and usually used a wheelchair, could walk using the power-assisted walker.

Further studies are required to develop the criteria concerning the suitability of walkers for elderly people.

ACKNOWLEDGMENT

We thank Drs. S. Egawa, T. Ishii, I. Takeuch and Y. Nemoto, Mechanical Engineering Research Laboratory, Hitachi Co. for his skillful assistance and valuable discussion. This work was partly supported by the New Energy and Industrial Technology Development Organization (NEDO) and Comprehensive research grant for aging and health.

REFERENCES